

others need new epithets in *Diospyros*; *D. labillardierei* F. White replaces the illegitimate *D. rufa* (Labill.) Fosb., and *D. tireliae* F. White is a new name for *Maba rosea* Montr. because its specific name is already occupied in *Diospyros*. Each of these species has a confused taxonomic history and for that reason they are given the same treatment as the new species. There are no nomenclatural problems concerning the four remaining New Caledonian species in section *Maba* (*D. pancheri* Kosterm., *D. parviflora* (Schltr.) Bakh., *D. vieillardii* (Hiern) Kosterm. and *D. yaouhensis* (Schltr.) Kosterm.) but they have been confused with other species in the section, and are therefore discussed in relation to them in the third part of this publication.

The last world-wide monograph of *Ebenaceae* at the species level (HIERN, 1873) was published when the botanical exploration of New Caledonia had scarcely begun. HIERN records the following 10 species from New Caledonia: *Diospyros ebenum* Koenig, *D. macrocarpa* Hiern, *D. olen* Hiern, *Maba buxifolia* Pers. (correctly *M. buxifolia* (Rottb.) A. L. Juss.), *M. elliptica* J. R. & G. Forst., *M. fasciculosa* F. Muell. (now *D. fasciculosa* (F. Muell.) F. Muell.), *M. foliosa* A. Gray, *M. rufa* Labill. (now *D. labillardierei* F. White), *M. ruminata* Hiern (now *D. fasciculosa* (F. Muell.) F. Muell.) and *M. vieillardii* Hiern (now *D. vieillardii* (Hiern) Kosterm.). The New Caledonian specimens of 4 of HIERN's species, namely *D. ebenum*, *M. buxifolia*, *M. elliptica* and *M. foliosa* were misidentified, and a fifth (*M. ruminata*) is a synonym. Therefore only 5 still stand, 4 retaining their original epithets.

HIERN's delimitation of species was sometimes idiosyncratic (not only for New Caledonian species), and this has adversely affected subsequent work. For example, under *Maba rufa* he cited specimens which are now assigned to *D. parviflora* (Schltr.) Bakh., *D. revolutissima* F. White and *D. yaouhensis* (Schltr.) Kosterm. His concept of *M. buxifolia* was even wider and for New Caledonia alone he included what are now regarded as five distinct species (*D. calciphila* F. White, *D. flavocarpa* (Vieill. ex Parmentier) F. White, *D. minimifolia* F. White, *D. umbrosa* F. White and *D. vieillardii* (Hiern) Kosterm.). HIERN's treatment of *M. rufa* and *M. buxifolia*, and of other species now placed in section *Maba* led to increasing subsequent confusion, not only in New Caledonia (GUILLAUMIN, 1922, 1948, 1967) but also throughout the tropical Far East (BAKHUIZEN, 1933, 1936-55). Important mis-identifications in the literature are cited in full in the 'Flora'. In the present account they are summarized in Table 1.

HIERN included 5 genera in *Ebenaceae*, *Diospyros* L., *Euclea* Murr., *Maba* J. R. & G. Forst., *Royena* L. and *Tetracリス* Hiern, of which only the first two are recognized today. The Far Eastern species of *Maba* were transferred to *Diospyros* by BAKHUIZEN (1933, 1936-55), the Neotropical ones by STANDLEY (1935), and the African ones by WHITE (1956), but *Maba* continued to be used in New Caledonia (GUILLAUMIN, 1948, 1967) and Madagascar (PERRIER, 1952), though PERRIER admitted that the distinctions between *Diospyros*, *Maba* and *Tetracリス* are weak. The Malagasy species of *Maba* and *Tetracリス* are the only *Ebenaceae* other than *Euclea* which have not yet been transferred to *Diospyros*. The new combinations are to be made in another publication (WHITE & SCHATZ, in prep.).

This study of New Caledonian *Ebenaceae* began in 1970 and has continued intermittently since then. In 1970 the material in British herbaria was sparse and mostly misidentified. It

TABLE 1 : Principal published misidentifications of New Caledonian *Diospyros* belonging to section *Maba* (the two crosses in each column indicate species which have been confused).

A, New Caledonian species; **B**, species not known to occur in New Caledonia, but erroneously recorded.

C, the numbers refer to the following authors : 1, BAKHUIZEN (1937); 2, BAKHUIZEN (1941); 3, GUILLAUMIN (1922); 4, GUILLAUMIN (1967); 5, HIERN (1973).

D, references to illustrations and distribution maps included in this paper.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	D
A. <i>D. parvifolia</i>	×	×	×	×	×															13 & 15
<i>D. labillardierei</i>	×					×	×	×												3
<i>D. perplexa</i>						×			×											3 & 15
<i>D. pancheri</i>										×										4
<i>D. yaouhensis</i>							×		×		×									5 & 15
<i>D. revolutissima</i>		×						×												6 & 15
<i>D. impolita</i>			×																	7 & 16
<i>D. pustulata</i>												×								6
<i>D. vieillardii</i>													×	×						14 & 16
<i>D. umbrosa</i>															×	×				8 & 9
<i>D. tireliae</i>															×					1 & 10
<i>D. flavocarpa</i>																	×			10 & 11
<i>D. calciphila</i>																		×		11 & 12
<i>D. minimifolia</i>																			×	11 & 16
B. <i>M. elliptica</i>				×																—
<i>M. buxifolia</i>													×			×	×	×	×	—
<i>M. foliosa</i>					×					×	×	×								—
<i>D. ferrea</i>														×						—
C. —	5	2	3	5	4	4	5	5	4	5	2	4	5	1	3	4	5	5	3	—

seemed that there were more species than had been previously recognized but the differences remained elusive until it was possible to study the ample collections in P and NOU making full use of the collectors' field notes and using rigorous methods of visual analysis.

For most species, the collectors' notes for individual gatherings, though not copious, collectively enabled an ecological profile to be drawn up. Nearly all species were found to have distinct, sometimes unique, ecogeographical distributions closely linked with climate and the geological substrate. The extremely diverse physical environments of New Caledonia have been described in great detail (Atlas de la Nouvelle-Calédonie, 1981; PARIS, 1981; BROOKS, 1987; CHERRIER, 1986; JAFFRÉ, 1974, 1980; JAFFRÉ & LATHAM, 1974; MORAT et al., 1984, 1986; VIROT, 1956). For the 'Flora' and this account additional information has been provided by New Caledonian residents, especially Dr. H. S. MACKEE...

Of the 24 New Caledonian species in section *Maba*, a few, e.g. *D. trisulca* F. White and *D. veillonii* F. White, cannot be confused with any others, but for the majority, although they are easy to recognize by a trained 'eye', it is difficult to express the differences in words. It is therefore necessary to illustrate them. Every New Caledonian species of *Diospyros* is unique in the precise details of its floral construction (Fig. 2, 15, 16), but, because flowers with open corollas are rarely available on herbarium specimens, leaves and fruits are of more practical use.

There is virtually no overlap in leaf-shape between species in section *Maba*. Most specimens can be recognized on leaf-shape alone, but it is necessary to illustrate it accurately and comprehensively, because in most species this is a variable feature. For 15 species leaves were drawn (Fig. 3-7, 9, 13, 14) to show their entire range of variation in leaf-outline and size. By combining the leaf drawings with a distribution map (pictorialized distribution map) any geographical trends that there may be in this feature are then revealed.

Most leaves were illustrated in silhouette which focusses exclusively on outline, whereas if indumentum and venation had been portrayed, as in conventional drawings, that might have been a distraction. However, indumentum and venation have been shown when they are of high diagnostic value. The pictorialized distribution maps, if they are supplemented by the text, confirm what had been detected by 'eye', namely that each species is virtually unique in its leaf-shape.

Ten New Caledonian species of *Diospyros* (*D. calciphila*, *D. fasciculosa*, *D. flavocarpa*, *D. minimifolia*, *D. olen*, *D. parviflora*, *D. umbrosa*, *D. vieillardii* and *D. yaouhensis*) were kept in cultivation in a greenhouse in Oxford for up to 20 years. They retained their species-specific vegetative characters, and in some cases (e.g. *D. minimifolia* from Pouembout) those of the local population from which the seed was obtained.

Chromosome counts have been made for 9 species, in all of which $2n = 30$.

The *Ebenaceae* of New Caledonia are still undercollected and imperfectly known. Three of the most distinct species (*D. margaretae*, *D. trisulca* and *D. veillonii*) were discovered after the present study began. There are surely others still to be found. Spirit material is sparse. Because of the articulated pedicel, flowers are easily lost from herbarium specimens, few of which have open corollas remaining. Preservation in collecting fluid is the only way to circumvent this.

Little is known about pollination and dispersal.

ENUMERATION OF THE SPECIES

1. *Diospyros brassica* F. White, *sp. nov.* — Fig. 1, 2.

Inter species Novae-Caledoniae singularis ob folia grandia, valde bullata, et inflorescentias grandes, congestas, coralloideas, in ramulis senioribus gestas.

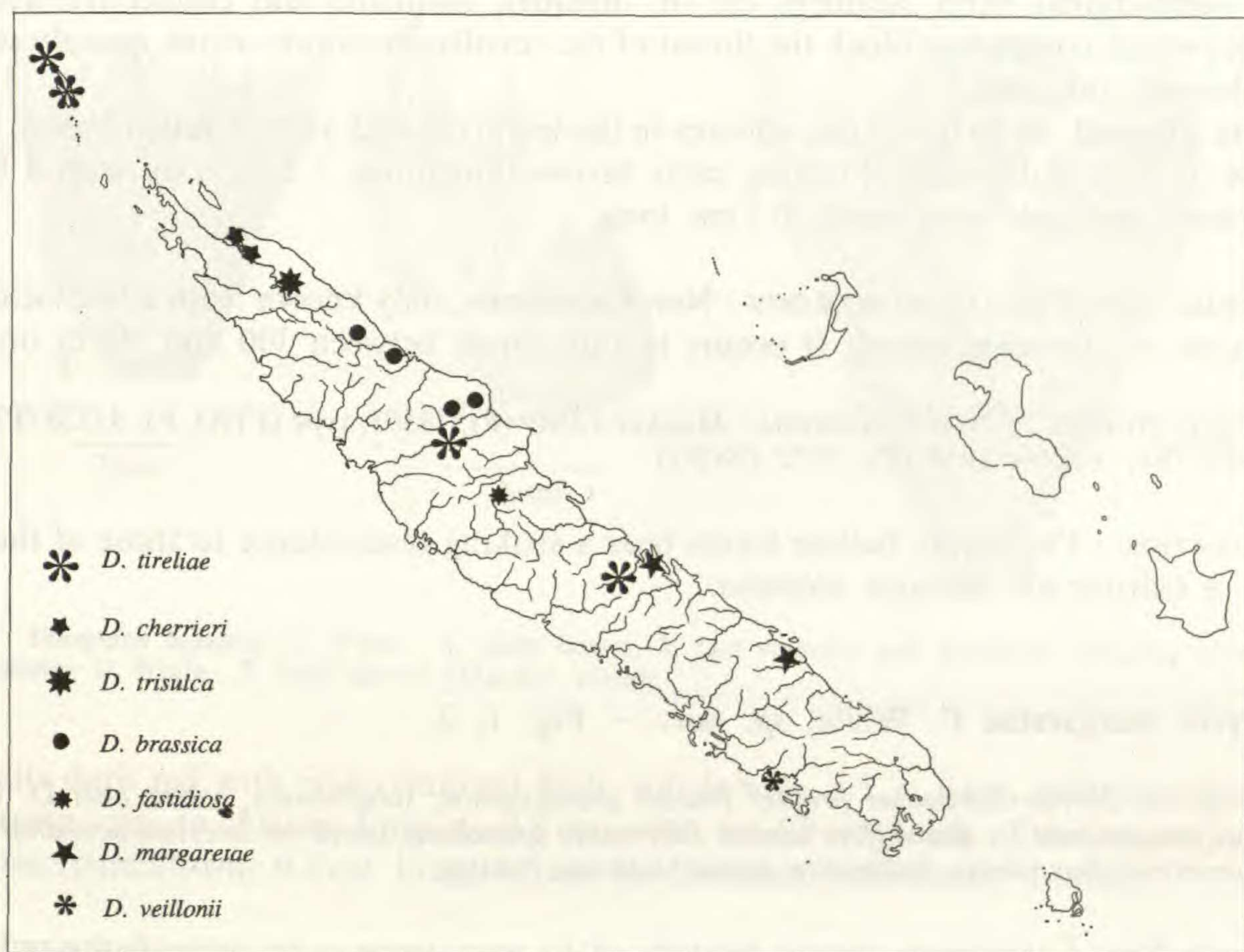


Fig. 1. — Distribution of 7 species of **Diospyros**.

Unique among New Caledonian species in its large strongly bullate leaves and large, congested coralloid inflorescences which are borne on the older branchlets.

TYPE : *MacKee 18501*, New Caledonia, Hienghène, Ouenguip, 400 m, 21.3.1968, ♂ fl. (holo-, P; iso-, FHO).

Tree 4-12 m tall, slender, branches pendant. Young branchlets purple-black, tomentose, slightly zigzag, not or scarcely flattened, older branchlets glabrous, closely and rather deeply furrowed and ridged, bark dark grey. Leaves coriaceous, drying dark brown; lamina up to 20×7.5 (30×12.5) cm, strongly bullate, lanceolate-elliptic, apex obtuse, base suddenly narrowed and decurrent along the upper part of the petiole, margin slightly revolute, more distinctly so towards the base; lower surface densely puberulous, especially on the nerves and veins; lateral nerves in ca. 12-14 pairs, they and the tertiary nerves deeply impressed above and very prominent beneath.

Male flowers 4-merous, borne at first in subsessile, axillary, congested, 5-11-flowered inflorescences which continue to produce flowers year after year on the old wood, eventually forming coralloid masses of old inflorescence-axes up to 5 cm in diameter. Calyx 0.5-0.6 cm long, glabrous inside except near apex, densely strigulose outside, lobes 0.3 cm long, ovate-deltate. Corolla 0.8 cm long, lobed to three-quarters, densely strigulose outside except for a

glabrous submarginal band. Stamens ca. 16, unequal, filaments and connective with long setose hairs which completely block the throat of the corolla. Pistillode ovoid, densely setulose. Female flowers unknown.

Fruits ellipsoid, up to 6×3 cm, solitary in the leaf-axils and axils of fallen leaves, brown-tomentose at first, glabrescent. Fruiting calyx brown-tomentose, 1.5 cm long with 4 broadly deltate lobes; peduncle very stout, 0.5 cm long.

DISTRIBUTION (Fig. 1) AND ECOLOGY : New Caledonia; only known from a few localities in the northeast of the main island. It occurs in rain forest between 300 and 900 m on schist.

MATERIAL STUDIED. — NEW CALEDONIA : *MacKee* 13809 (P), 18501, type (FHO, P), 35728 (P), 36421, leg. *Cherrier* (P); *Veillon* 1954 (P), 2772 (NOU).

DERIVATION : The deeply bullate leaves bear a striking resemblance to those of the Savoy cabbage, a cultivar of *Brassica oleracea*.

2. *Diospyros margaretae* F. White, *sp. nov.* — Fig. 1, 2.

Inter species Novae-Caledoniae propter fructus grandissimos, subglobosos, solum cum D. balansae Guillaumin comparanda; a qua differt lamina folii multo grandiore, acuta vel breviter acuminata, nervis venisque prominentibus, denso indumento pagine inferiore vestita.

Among New Caledonian species because of its very large subglobose fruits only to be compared with *D. balansae* Guillaumin from which it differs in its much larger acute or shortly acuminate leaf-lamina which has prominent nerves and veins and a dense indumentum on the lower surface.

TYPE : *MacKee* 33396, New Caledonia, Kouaoua, Dahi, 500 m, 25.6.1977, ♀ fl., fr. (holo-, P, ♀ fl.; iso-, P, fr.).

Tree up to 10 m tall, slender, trunk 8-15 cm in diameter, branched only near the apex, branches pendulous, bark brown, slightly rough. Young branchlets rusty-tomentellous, slightly zigzag, not or scarcely flattened; older branchlets glabrous, brown or blackish, more or less smooth. Leaves chartaceous, drying reddish-brown; lamina up to 29×12 cm, broadly lanceolate, apex acute or shortly acuminate, base subtruncate or subcordate, auriculate, margin not or slightly revolute except near the base; lower surface shortly tomentose; lateral nerves in ca. 12 pairs, not or slightly impressed above, very prominent beneath, tertiary nerves and veins forming a slightly prominent reticulum beneath.

Male flowers in ca. 10-flowered axillary cymes, which are enclosed at first by ca. 8 squamiform bracts. Calyx 0.4-0.5 cm long, glabrous inside except near the apex, finely sericeous outside, lobes 0.2-0.3 cm long, ovate-deltate. Corolla 0.8-0.9 cm long, lobed to three-quarters, sericeous-tomentellous outside. Stamens ca. 16, unequal, filaments and connective with long setose hairs which completely block the throat of the corolla. Pistillode conoidal, densely setulose. Female flowers solitary, subsessile, axillary, similar to the male in external appearance but larger.

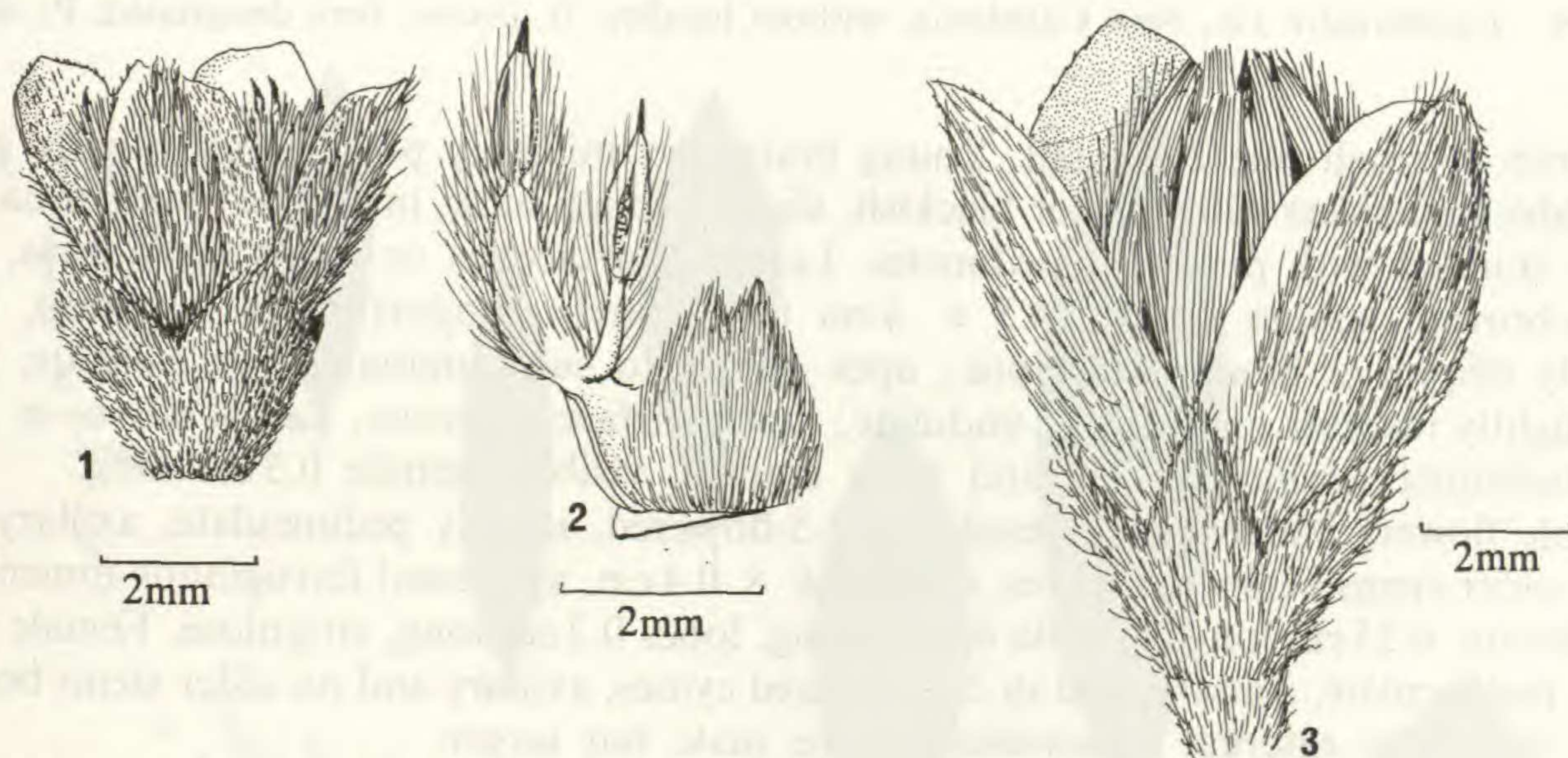


Fig. 2. — *Diospyros brassica* F. White : 1, male flower, 2, two stamens and pistillode (MacKee 18501). — *D. margaretae* F. White : 3, male flower (MacKee 45000).

Fruits dark red with pink, fragrant flesh, subglobose, 5.5×6 cm, glabrous. Seeds ca. 4, dark brown, up to 3.5 cm long \times 2.8 cm wide \times 1.5 cm thick. Fruiting calyx shortly tomentose, patelliform, 0.5 cm long, 1.5 cm in diameter, indistinctly 4-lobed.

DISTRIBUTION (Fig. 1) **AND ECOLOGY** : New Caledonia ; only known from two localities in the southeast of the main island, where it occurs in the understorey of rain forest, including *Agathis lanceolata* forest. It is locally common.

MATERIAL STUDIED. — NEW CALEDONIA : MacKee 33396, type (P), 33400 (P), 44810 (P), 45000 (P), 45201 (P); Veillon 3036 (P).

DEDICATION : *Hanc notabilem speciem in memoriam Margaretae Elizabethae MacKee dedico, quae specimina numerosissima plantarum in sylvis montibusque Novae-Caledoniae summa cum cura confecit.*

3. *Diospyros labillardierei* F. White, *nom. nov.* — Fig. 3.

— *Maba rufa* LABILL., Sert. Austro-Caled. 1 : 33, tab. 36 (1824).

— *Diospyros rufa* (LABILL.) FOSB., Bull. Torrey Cl. 65 : 613 (1939) *non D. rufa* KING & GAMBLE (1905).

A *D. parviflora* (Schltr.) Bakh. *facile distincta propter habitum saliciformem caulibus gracilibus, sparse ramosis, et foliis parvis redditam. Praeterea fructus sunt manifeste minores et calyx fructificans multo subtilius et sparsius pilosus.*

Easily distinguished from *D. parviflora* (Schltr.) Bakh. because of its *Salix*-like appearance with slender, sparsely branched stems and narrow leaves. In addition its fruits are appreciably smaller and the fruiting calyx is much more delicate and more sparsely hairy.

TYPE : *Labillardière s.n.*, New Caledonia, without locality, fr. (lecto-, here designated, P; isolecto-, FI-W).

Shrub or small tree 2-6 m tall. Young branchlets minutely puberulous, rapidly glabrescent; older branchlets with grey or blackish, slightly rough bark, in female plants usually also densely studded with persistent peduncles. Leaves chartaceous or thinly coriaceous, drying reddish-brown; lamina up to 14.5×4 cm (very rarely proportionally broader), usually narrowly elliptic or lanceolate-elliptic; apex obtuse to subacuminate, base cuneate, margin often slightly revolute and slightly undulate; lower surface glabrous; lateral nerves in $\pm 7-10$ pairs, indistinct; tertiary nerves and veins scarcely visible; petiole 0.5 cm long.

Male flowers 3-merous, subsessile, in 2-5-flowered, shortly pedunculate, axillary cymes and on older stems below the leaves. Calyx 0.6×0.4 cm, appressed ferruginous-tomentellous, lobes deltate, 0.25 cm long. Corolla 0.8 cm long, lobes 0.2 cm long, strigulose. Female flowers shortly pedunculate, solitary, and in 2-3-flowered cymes, axillary and on older stems below the leaves, similar in external appearance to the male but larger.

Fruits ellipsoid, ca. 1.6×1.2 cm, densely puberulous with appressed whitish hairs. Fruiting calyx shallowly cup-shaped, slightly wider than the fruit, ± 0.6 cm long, puberulous to sericeous-tomentellous outside, appressed tomentellous inside, shallowly 3-lobed, lobes broadly deltate, 0.15 cm thick, margin not recurved.

DISTRIBUTION (Fig. 3) AND ECOLOGY : New Caledonia; widespread in the central and northeastern parts of Grande-Terre, on schists between 100 and 550 m. Apparently it is a rheophyte confined to riparian forest including river beds and waterfalls.

MATERIAL STUDIED. — NEW CALEDONIA : *Balansa* 2480 (P), 3345 (K, P, Z); *Blanchon* 1196 (NOU); *Däniker* 1724 (P, Z); *Franc* 762 (K, P, Z); *Labillardière s.n.*, type (FI-W, P); *Lécard s.n.* (P); *MacKee* 13168 (P), 13739 (P), 13742 (P), 17747 (P), 15162 (P), 19242 (FHO, P), 26253 (FHO), 26719 (FHO), 27658 (FHO, P), 30794 (FHO), 33026, leg. *Cherrier* (FHO, P); *McPherson* 1887 (FHO, P); *Schmid* 5250 (P); *Veillon* 1552 (NOU, P); *Vieillard* 894 (K, L, P, Z); *Viot* 1372 (P).

DEDICATION : Named for Jacques Julien de HOUTTOU LABILLARDIÈRE, French explorer and botanist, who, on an expedition (1791-1795) to find LA PÉROUSE, was the first person to collect *Diospyros* in New Caledonia.

4. *Diospyros perplexa* F. White, *sp. nov.* — Fig. 3, 15.

A *D. parviflora* (Schltr.) Bakh. *differt foliis oblongis vel oblongo-ellipticis apice abrupte et breviter acuminatis, et lobis calycis et floris feminei et fructus longioribus, magis attenuatis.*

Differs from *D. parviflora* (Schltr.) Bakh. in its oblong or oblong-elliptic, suddenly and shortly acuminate leaves and in its longer more attenuate calyx lobes, both in the female flower and fruit.

TYPE : *Veillon* 7145, New Caledonia, Paita, Pic Géré, 150 m, 13.9.1989, fr. (holo-, P; iso-, FHO).

Shrub or small tree 2-15 m tall. Young branchlets slender, puberulous; older branchlets with more or less smooth grey bark. Leaves thinly coriaceous, drying pale brown or pinkish-

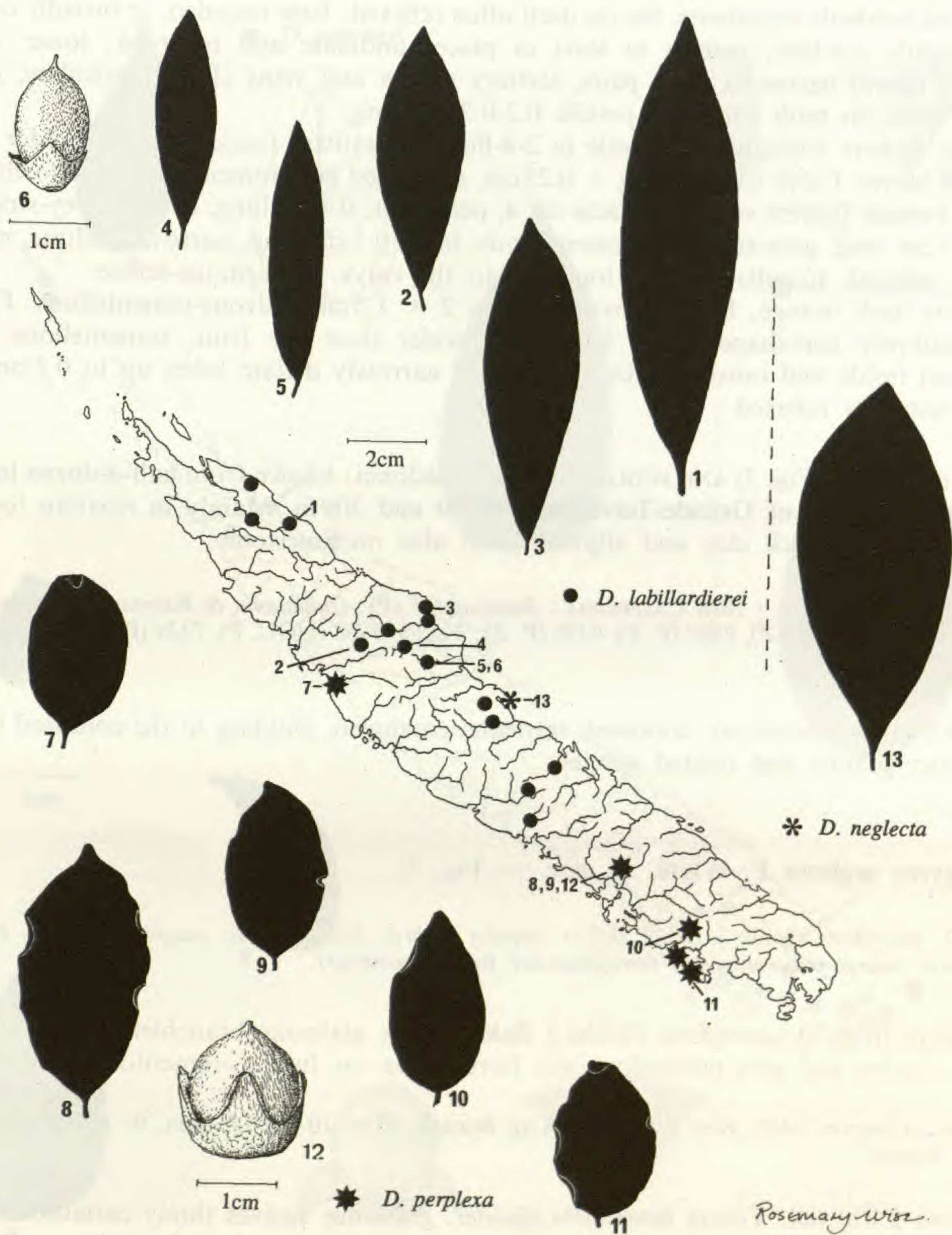


Fig. 3. — *Diospyros labillardierei* F. White: 1-5, leaves selected to show the range of variation in shape and size of the species; 6, fruit and fruiting calyx (1, Däniker 1724; 2, MacKee 26253; 3, MacKee 26719; 4, MacKee 19242; 5, MacKee 13742; 6, MacKee 13168). — *D. perplexa* F. White: 7-11, leaves selected to show the range of variation in shape and size of the species; 12, fruit and fruiting calyx (7, Veillon 6968; 8, Guillaumin & Baumann-Bodenheim 9255; 9, Guillaumin & Baumann-Bodenheim 9302; 10, Veillon 7134; 11, Balansa 465; 12, Guillaumin & Baumann-Bodenheim 9302). — *D. neglecta* F. White: 13, a typical leaf (Compton 1400).

brown; lamina up to 8.5 cm long and 4.5 cm broad, oblong or oblong-elliptic, apex usually shortly and suddenly acuminate, the tip itself often reflexed; base rounded, or broadly cuneate, rarely slightly cordate; margin at least in places undulate and recurved; lower surface glabrous; lateral nerves in ca. 6 pairs, tertiary nerves and veins closely reticulate, usually clearly visible on both surfaces; petiole 0.2-0.3 cm long.

Male flowers 3-merous, subsessile in 2-4-flowered axillary fascicles and on older shoots below the leaves. Calyx (in bud) 0.6×0.25 cm, appressed grey-tomentellous, shallowly lobed at apex. Female flowers solitary. Bracts ca. 4, persistent, 0.5 cm long, densely grey-strigulose. Calyx 1.1 cm long, grey-strigulose-tomentellous, lobes 0.7 cm long, narrowly deltate, margins strongly reflexed. Corolla scarcely longer than the calyx, ferruginous-setose.

Fruits dark orange, broadly ovoid, up to 2×1.5 cm, fulvous-tomentellous. Fruiting calyx shallowly cup-shaped, ± 1.5 cm long, wider than the fruit, tomentellous (rarely tomentose) inside and outside, with 3 deltate or narrowly deltate lobes up to 0.2 cm thick, margin distinctly reflexed.

DISTRIBUTION (Fig. 3) AND ECOLOGY : New Caledonia; known from half-a-dozen localities on the western side of Grande-Terre between 20 and 200 m. Mainly in riparian forest on phtanites, flysch, black clay and alluvium, but also on limestone.

MATERIAL STUDIED. — NEW CALEDONIA : *Balansa* 465 (P); *Guillaumin & Baumann-Bodenheim* 9233 (P), 9255 (P, Z), 9297 (P, Z), 9302 (P, Z), 9326 (P, Z); *Veillon* 6968 (NOU, P), 7134 (P), 7145, type (FHO, P).

DERIVATION : *perplexus*, confused, intricate, entangled, alluding to the confused taxonomic history of this and related species.

5. *Diospyros neglecta* F. White, *sp. nov.* — Fig. 3.

A D. parviflora (Schltr.) Bakh. *differt ramulis glabris, foliis glabris, magis attenuatis, et calyce fructificante cinereo-puberulo (non ferrugineo-nec fulvo-tomentoso).*

Differs from *D. parviflora* (Schltr.) Bakh. in its glabrous branchlets, more attenuate glabrous leaves and grey-puberulous not ferruginous- or fulvous-tomentose fruiting calyx.

TYPE : *Compton* 1400, New Caledonia, Cap Bocage, 65 m, 10.7.1914, imm. fr. (holo-, BM). Only material known.

Shrub 2.6 m tall. Young branchlets slender, glabrous. Leaves thinly coriaceous, drying grey-brown above, pale reddish-brown beneath; lamina up to 9.5×4 cm, elliptic or oblanceolate-elliptic, apex acute to subacuminate, base cuneate or narrowly cuneate, margin slightly undulate and slightly recurved; lower surface glabrous; lateral nerves in about 7 not very conspicuous pairs, venation closely reticulate, visible but indistinct on both surfaces.

Male and female flowers unknown.

Fruits (immature) broadly ellipsoid, ferruginous-tomentose. Fruiting calyx cup-shaped,

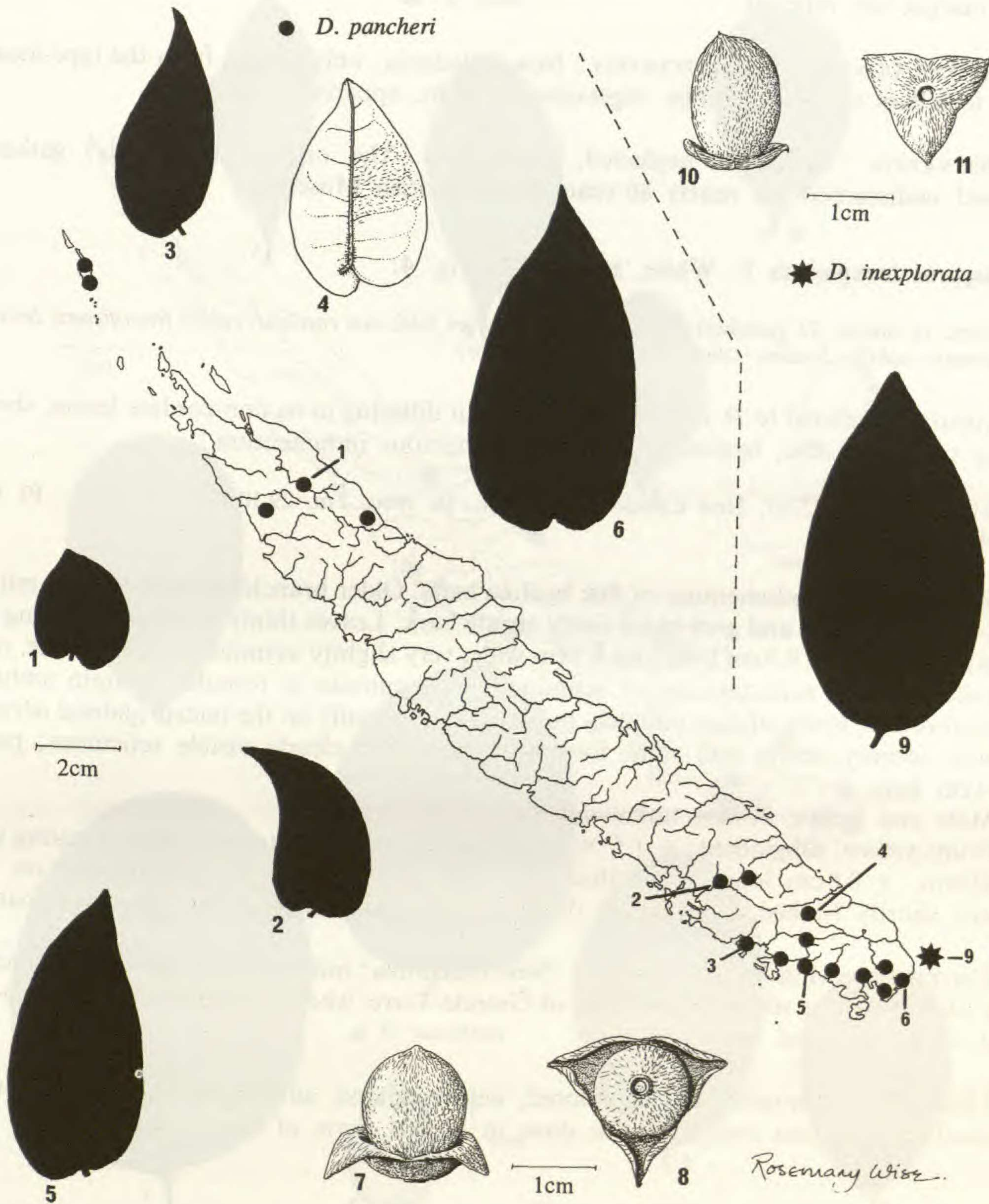


Fig. 4. — *Diospyros pancheri* Kosterm. : 1-6, leaves selected to show the range of variation in shape and size of the species; 7, fruit and fruiting calyx; 8, fruiting calyx seen from below (1, Veillon 2982; 2, Blanchon 1292; 3, Veillon 7232; 4, Veillon 7266; 5, Tirel 1199; 6, MacKee 22926; 7, 8, Blanchon 1292). — *D. inexplorata* F. White : 9, a typical leaf; 10, fruit and fruiting calyx; 11, fruiting calyx seen from below (9, 10, 11, MacKee 22791).

wider than the fruit, grey-puberulous outside, ferruginous-tomentose inside, with 3 deltate lobes, margin not reflexed.

DISTRIBUTION (Fig. 3) AND ECOLOGY : New Caledonia; only known from the type-locality where it occurs in open scrubby vegetation at 65 m, apparently on basalt.

DERIVATION : *neglectus*, neglected, disregarded. The original (and only) gathering remained undisturbed for nearly 80 years at the British Museum.

6. **Diospyros inexplorata** F. White, *sp. nov.* — Fig. 4.

Affinis, ut videtur, D. pancheri Kosterm.; *a qua differt foliis non cordatis, calyce fructificante brevior, et indumento subtili, hyalino (non grosso et ferrugineo).*

Apparently related to *D. pancheri* Kosterm. but differing in its non-cordate leaves, shorter fruiting calyx and fine, hyaline, not coarse ferruginous indumentum.

TYPE : *MacKee* 22791, New Caledonia, Kuebini, Ile Nou, 2 m, 29.10.1970, fr. (holo-, P). Only material known.

Shrub 3 m tall. Indumentum of fine hyaline hairs. Older branchlets slender, with minute, short, spreading hairs and grey-black finely striate bark. Leaves thinly coriaceous, drying pale brown; lamina up to 8.5 cm long and 4.5 cm wide, very slightly asymmetric, not falcate, ovate or lanceolate, apex subacuminate or acuminate, base cuneate or rounded, margin undulate, slightly revolute; lower surface minutely puberulous, especially on the midrib; lateral nerves in 5-7 pairs, tertiary nerves and veins forming a close and clearly visible reticulum; petiole ca. 0.3 cm long.

Male and female flowers unknown.

Fruits yellow, subglobose, $\pm 1.5 \times 1.2$ cm, persistently grey-tomentellous. Fruiting calyx patelliform, ± 0.8 cm long, wider than the fruit, persistently grey-tomentellous on both surfaces, shortly 3-lobed, lobes 0.2 cm thick, broadly deltate with slightly recurved margins.

DISTRIBUTION (Fig. 4) AND ECOLOGY : New Caledonia; only known from the type-locality, a tiny island near the southern extremity of Grande-Terre, where it occurs just above sea-level in tall forest on coral limestone.

DERIVATION : *inexploratus*, unexplored, uninvestigated, alluding to the fact that much botanical investigation remains to be done in certain parts of New Caledonia.

7. **Diospyros glans** F. White, *sp. nov.* — Fig. 5, 15.

D. yaouhensi (Schltr.) Kosterm. *habitu similis, sed differt foliis angustioribus, constanter glabris, magis cuneatis, et calyce fructificante glabro vel sparse et minute puberulo, ruguloso, vix lobato, margine reflexo carente.*

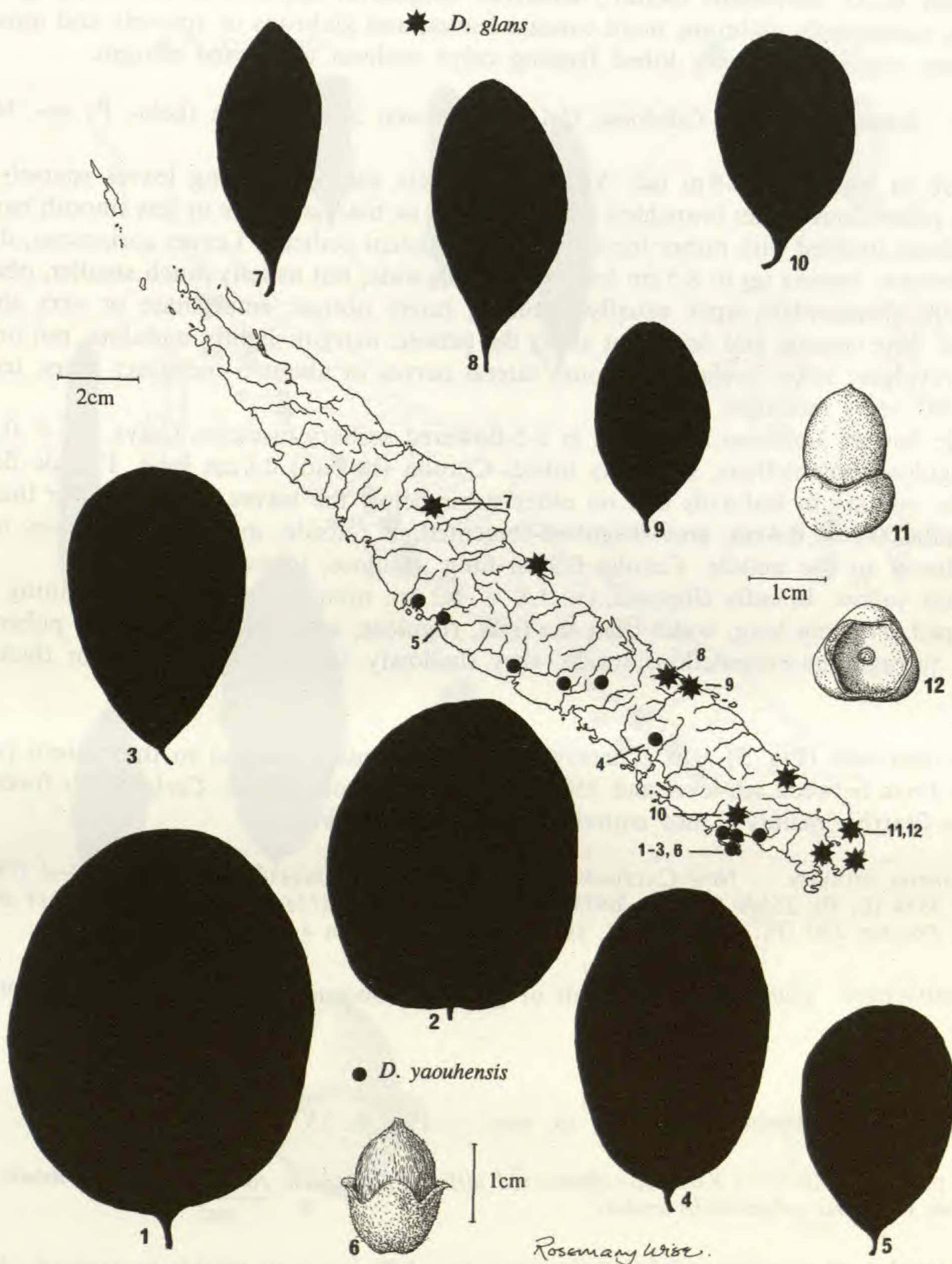


Fig. 5. — *Diospyros yaouhensis* (Schltr.) Kosterm. : 1-5, leaves selected to show the range of variation in shape and size of the species; 6, fruit and fruiting calyx (1, Veillon 6636; 2, MacKee 24701; 3, Balansa 463; 4, Guillaumin & Baumann-Bodenheim 9311; 5, Veillon 6428; 6, MacKee 33552). — *D. glans* F. White : 7-10, leaves selected to show the range of variation in shape and size of the species; 11, fruit and fruiting calyx; 12, fruiting calyx seen from above (7, Jérémie & Tirel 1783; 8, Schmid 4831; 9, Balansa 3644; 10, MacKee 3314; 11, 12, Suprin 416).

Similar to *D. yaouhensis* (Schltr.) Kosterm. in general appearance but differing in its narrower, consistently glabrous, more cuneate leaves, and glabrous or sparsely and minutely puberulous, rugulose, scarcely lobed fruiting calyx without a reflexed margin.

TYPE : *Schmid 4831*, New Caledonia, Col de Petchicara, 30.11.1973, fr. (holo-, P; iso-, NOU).

Shrub or small tree 4-8 m tall. Young branchlets and very young leaves sparsely and minutely puberulous; older branchlets with dark grey or blackish more or less smooth bark, in female plants studded with rather inconspicuous persistent pedicels. Leaves coriaceous, drying reddish-brown; lamina up to 8.5 cm long and 5.5 cm wide, but usually much smaller, obovate to broadly oblanceolate, apex usually rounded, rarely obtuse, emarginate or very shortly cuspidate, base cuneate and decurrent along the petiole, margin slightly undulate, not or very slightly revolute; lower surface glabrous; lateral nerves in about 5 indistinct pairs, tertiary nerves and veins reticulate, indistinct.

Male flowers 3-merous, subsessile in 2-5-flowered axillary fascicles. Calyx 0.4×0.3 cm, grey-strigulose-tomentellous, shallowly lobed. Corolla (in bud) 0.6 cm long. Female flowers subsessile, solitary in leaf-axils and on older stems below the leaves. Calyx shorter than the corolla-tube, 0.5×0.4 cm, grey-strigulose-tomentellous outside, more coarsely hairy inside, lobed almost to the middle. Corolla 0.9 cm long, setulose, lobes 0.2 cm long.

Fruits yellow, broadly ellipsoid, ca. 1.8×1.2 cm, minutely puberulous. Fruiting calyx cup-shaped, 1-1.2 cm long, wider than the fruit, rugulose, sparsely and minutely puberulous outside, ferruginous-tomentellous inside, very shallowly 3-lobed, margin 0.2 cm thick, not reflexed.

DISTRIBUTION (Fig. 5) AND ECOLOGY : New Caledonia; confined to the eastern part of Grande-Terre between sea-level and 250 m. It grows in moist forest, *Cerberiopsis* forest and 'maquis fourré', mainly if not entirely on ultrabasic rocks.

MATERIAL STUDIED. — NEW CALEDONIA : *Balansa 463a* (P), 3644 (P); *Jérémie & Tirel 1783* (P); *MacKee 3314* (L, P), 25546 (FHO), 26655 (FHO), 27151 (P), 28724 (FHO); *Musselman et al. 5209* (NOU); *Pancher 550* (P); *Schmid 4831*, type (NOU, P); *Suprin 416* (NOU).

DERIVATION : *glans*, an acorn (fruit of *Quercus*), because of the shape of the fruit and fruiting calyx.

8. *Diospyros revolutissima* F. White, *sp. nov.* — Fig. 6, 15.

D. parviflorae (Schltr.) Kosterm. *affinis*, sed differt foliis crasse coriaceis, valde revolutis, nervis lateralibus innumeris subparallelis crebris.

Related to *D. parviflora* (Schltr.) Kosterm. but differing in its thickly coriaceous, strongly revolute leaves with multitudinous subparallel closely set lateral nerves.

TYPE : *Veillon 5272*, New Caledonia, Néhoué, 20.10.1982, fr. (holo-, P; iso-, NOU).

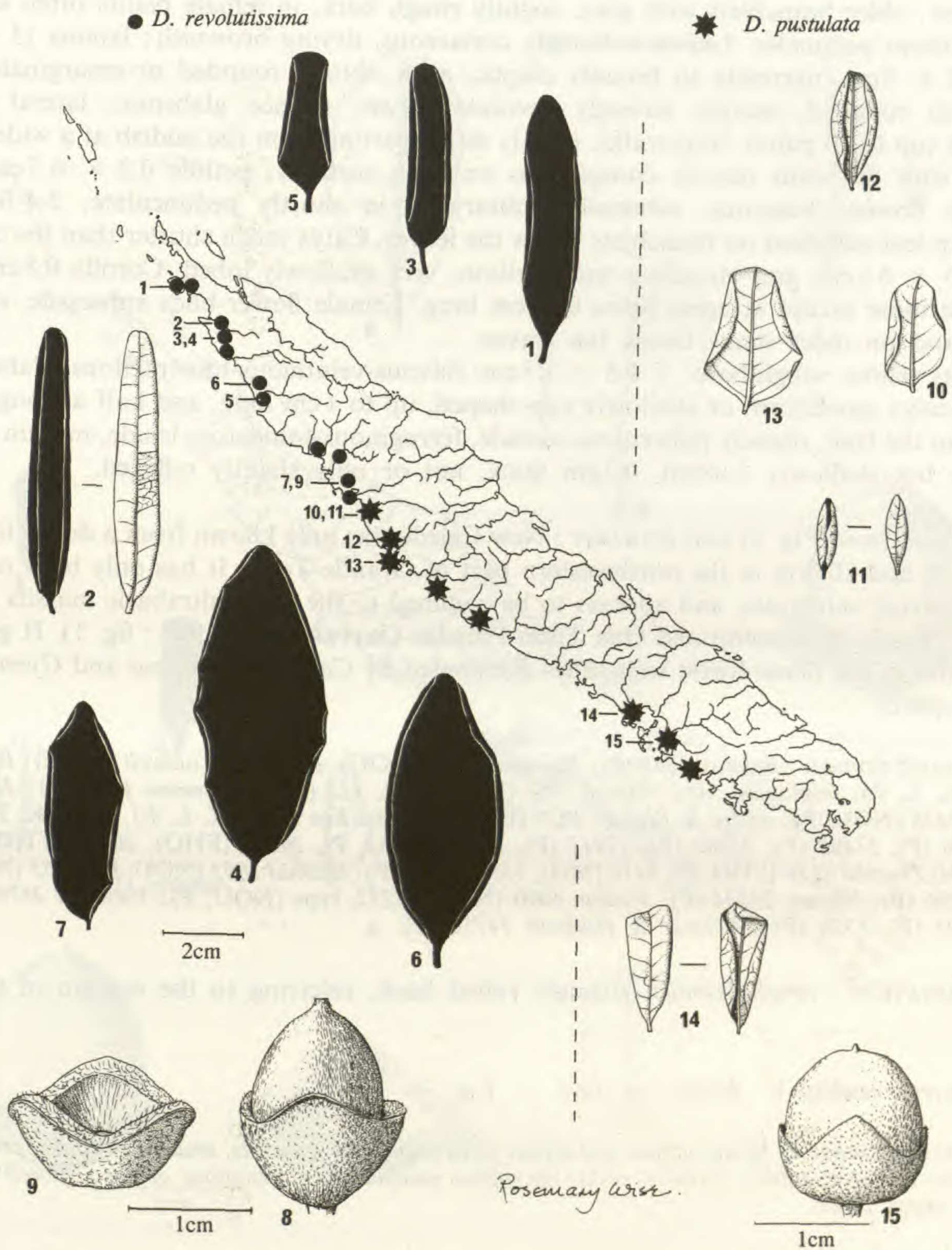


Fig. 6. — *Diospyros revolutissima* F. White: 1-7, leaves selected to show the range of variation in shape and size of the species; 8, fruit and fruiting calyx; 9, fruiting calyx (1, MacKee 27460; 2, Veillon 5272; 3, Jaffré 2438; 4, MacKee 35106; 5, Caldwell s.n.; 6, Jaffré & Rigault 3029; 7, MacKee 30015; 8, 9, McPherson 5355). — *D. pustulata* F. White: 10-14, leaves selected to show the range of variation in shape and size of the species; 15, fruit and fruiting calyx (10, Veillon 6963; 11, MacKee 24550; 12, Jaffré 2022; 13, Veillon 6664; 14, Veillon 6854; 15, Suprin 2132).

Shrub 70 cm to 5 m tall. Young branchlets and leaves minutely puberulous, rapidly glabrescent; older branchlets with grey, slightly rough bark, in female plants often studded with persistent peduncles. Leaves extremely coriaceous, drying brownish; lamina (3×1.5) 5×2 - 12×5 cm, narrowly to broadly elliptic, apex obtuse, rounded or emarginate, base cuneate to rounded, margin strongly revolute; lower surface glabrous; lateral nerves numerous (up to 20 pairs), subparallel, closely set, departing from the midrib at a wide angle, together with the veins usually conspicuous on both surfaces; petiole 0.2×0.5 cm long.

Male flowers 3-merous, subsessile, solitary or in shortly pedunculate, 2-4-flowered fascicles in leaf-axils and on branchlets below the leaves. Calyx much shorter than the corolla-tube, 0.35×0.3 cm, grey-strigulose-tomentellous, very shallowly lobed. Corolla 0.8 cm long, densely setulose except at apex, lobes 0.15 cm long. Female flower-buds subsessile, solitary, axillary and on older stems below the leaves.

Fruits yellow, subglobose, $\pm 1.5 \times 1.5$ cm, fulvous-velutinous-tomentellous, glabrescent. Fruiting calyx patelliform or shallowly cup-shaped, up to 1 cm long, and half as long as but wider than the fruit, densely puberulous outside, ferruginous-tomentose inside, margin usually distinctly but shallowly 3-lobed, 0.2 cm thick, not or only slightly reflexed.

DISTRIBUTION (Fig. 6) AND ECOLOGY : New Caledonia; only known from a dozen localities between 20 and 1050 m in the northwestern part of Grande-Terre. It has only been recorded from ultrabasic substrates, and appears to be confined to the main ultrabasic massifs (Poum, Tiébaghi, Kaala, Koniambo and Oua Tilou-Poindas (Jaffré et al., 1987 : fig. 1). It grows in maquis and in low dense forest sometimes dominated by *Cocconerion minus* and *Gymnostoma chamaecyparis*.

MATERIAL STUDIED : Balansa 3343 (P); Blanchon 1372 (NOU), 1572 (P); Caldwell s.n. (K); Deplanche 446 (G, K, L, P); Deplanche Mus. Néocal. 109 (P), 111 (P), 112 (P); Hürlimann 1288 (P); Jaffré 796 (NOU), 2438 (NOU, P); Jaffré & Rigault 3029 (FHO, P); MacKee 5516 (K, L, P), 6501 (K, P), 16141 (P), 16906 (P), 17495 (P), 22382 (P), 22412 (P), 27460 (FHO, P), 29547 (FHO), 30015 (FHO), 35106 (FHO); McPherson 3516 (FHO, P), 5318 (MO), 5355 (FHO, P); Schmid 2693 (NOU, P), 4865 (NOU, P); Suprin 1966 (P); Thorne 28234 (P); Veillon 4490 (NOU), 5272, type (NOU, P); Vieillard 2876 (K, P); Virot 1295 (P), 1329 (P); Webster & Hildreth 14716 (P).

DERIVATION : *revolutissimus*, strongly rolled back, referring to the margin of the leaf.

9. *Diospyros erudita* F. White, *sp. nov.* — Fig. 7.

D. revolutissimae F. White *affinis, sed differt foliis minoribus, cuneatis, undulatis, nitidis, proportione latis, minus coreaceis, minus revolutis, nervis lateralibus paucioribus et venatione obscura; flores masculini minores, minus pilosi.*

Related to *D. revolutissima* F. White but differing in its smaller, cuneate, undulate, glossy, proportionally broader, less coriaceous, less strongly revolute leaves with fewer lateral nerves, and indistinct venation, and in its smaller less hairy male flowers.

TYPE : MacKee 16863, New Caledonia, Pouembout, Tiéa (pente ouest), 100-350 m, 8.6.1967, fr. (holo-, P).

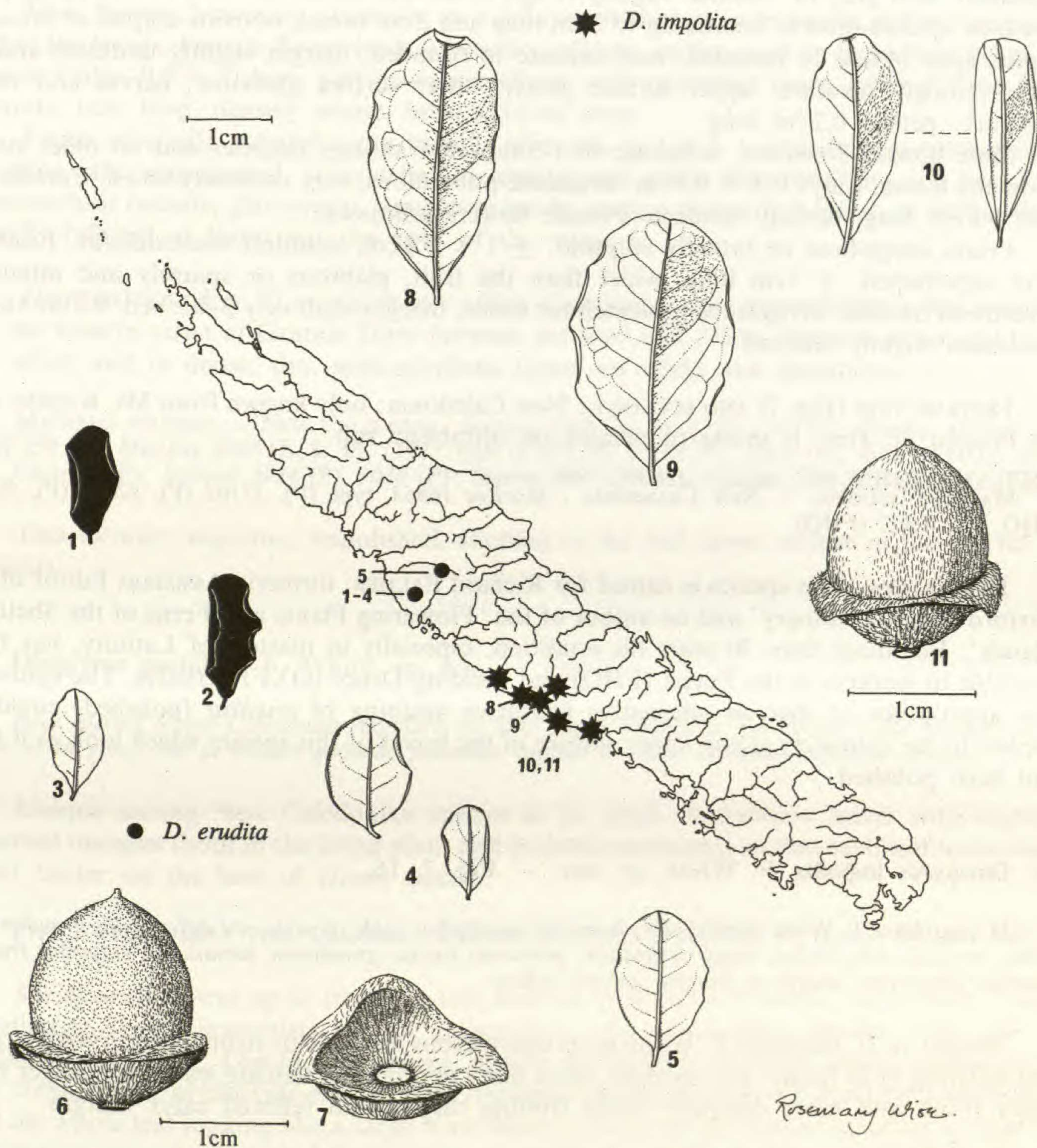


Fig. 7. — *Diospyros erudita* F. White : 1-5, leaves selected to show the range of variation in shape and size of the species; 6, fruit and fruiting calyx; 7, fruiting calyx seen from above (1, MacKee 30302; 2, MacKee 29562; 3, MacKee 22064; 4, MacKee 16863; 5, 6, 7, MacKee 17102). — *D. impolita* F. White : 8-10, leaves selected to show the range of variation in shape and size of the species; 11, fruit and fruiting calyx (8, Schmid 2934; 9, Schmid 5010; 10, 11, MacKee 36725).

Shrub, much-branched, 2-3 m tall. Young branchlets very slender, glabrous; older branchlets with grey or blackish slightly rough bark. Leaves thinly coriaceous, drying pale brown or reddish-brown; lamina up to 3 cm long and 2 cm broad, obovate-elliptic or broadly elliptic, apex obtuse to rounded, base cuneate to rounded, margin slightly undulate and in places strongly revolute; upper surface glossy, lower surface glabrous; nerves and veins indistinct; petiole 0.2 cm long.

Male flowers 3-merous, subsessile in 1-3-flowered axillary fascicles and on older stems below the leaves. Calyx 0.3×0.3 cm, strigulose-puberulous, very shallowly lobed. Corolla (in bud) 0.6 cm long, densely setulose. Female flowers unknown.

Fruits subglobose or broadly ellipsoid, $\pm 1 \times 0.8$ cm, minutely tomentellous. Fruiting calyx cup-shaped, ± 1 cm long, wider than the fruit, glabrous or sparsely and minutely puberulous outside, ferruginous-tomentellous inside, margin shallowly 3-4-lobed, 0.2 cm thick, sometimes slightly reflexed.

DISTRIBUTION (Fig. 7) AND ECOLOGY : New Caledonia; only known from Mt. Kopéto and the Plateau de Tiéa. It grows in maquis on ultrabasic soil.

MATERIAL STUDIED. — NEW CALEDONIA : MacKee 16863, type (P), 17102 (P), 22064 (P), 29562 (FHO, P), 30302 (FHO).

DERIVATION : This species is named for Richard PALMER, formerly Assistant Editor of the 'Oxford Latin Dictionary' and co-author of the 'Flowering Plants and Ferns of the Shetland Islands'. For more than 30 years his erudition, especially in matters of Latinity, has been available to workers in the Forest (FHO) and Fielding-Druce (OXF) herbaria. The epithet is also appropriate in that an alternative figurative meaning of *eruditus* (polished) could be applied to the extremely glossy upper surface of the leaves of this species which look as if they had been polished.

10. **Diospyros impolita** F. White, *sp. nov.* — Fig. 7, 16.

D. pustulatae F. White *similis foliis chartaceis marginibus valde recurvis, sed differt foliis grandioribus, minus revolutis, pilosioribus, magis reticulatis; praeterea fructus grandiores, hirsutiores, calycibus fructificantibus distinctius lobatis et margine calycis reflexo.*

Similar to *D. pustulata* F. White in its chartaceous leaves with strongly recurved margins, but differing in its larger, less revolute, more hairy and more reticulate leaves and larger more hairy fruits with more distinctly lobed fruiting calyces and reflexed calyx margin.

TYPE : MacKee 11923, New Caledonia, Bourail, Poé, 3.1.1965, fr. (holo-, P; iso-, FHO).

Shrub or small tree 3-6 m tall. Young branchlets fulvous-tomentose; older branchlets with grey or blackish, slightly rough bark. Leaves chartaceous, usually drying pale brown above, paler below; lamina (3.5×2.5) $4.5 \times 3-6.5 \times 3.5$ cm, elliptic or obovate-elliptic, apex rounded, base cuneate; margin recurved but less so than in *D. pustulata*; upper surface dull; lower surface at first densely pubescent to tomentose with weak, spreading hairs, glabrescent;

lateral nerves in 5-7 pairs, venation closely reticulate, clearly visible on both surfaces at least on older leaves; petiole 0.3-0.4 cm long.

Male flowers 3-merous, subsessile, in 2-5-flowered clusters in leaf-axils and on branchlets below the leaves. Female flower-buds subsessile, solitary, axillary and on branchlets below the leaves. Calyx 0.5×0.4 cm, fulvous-tomentellous with spreading hairs, lobes 0.25 cm long. Corolla 1 cm long, densely setose, lobes 0.15 cm long.

Fruits subsessile, subglobose or broadly ellipsoid, $\pm 1.8 \times 1.5$ cm, fulvous-tomentellous. Fruiting calyx cup-shaped, at least half as long as and wider than the fruit, ± 1.5 cm long, tomentellous outside, glabrescent, tomentose inside, margin distinctly 3-lobed, ± 0.2 cm thick, usually reflexed at least near the apex of the lobes.

DISTRIBUTION (Fig. 7) AND ECOLOGY : New Caledonia; only known from a few localities on the western coast of Grande-Terre between sea-level and 250 m. It grows in coastal forest on schist and in dense, dry, sclerophyllous forest on schist and limestone.

MATERIAL STUDIED. — NEW CALEDONIA : *Balansa* 1458 (K, P); *Cribs* 1223 (P); *Däniker* 1020 (P, Z); *Hoff* 959 (P); *MacKee* 8048 (K, L, P), 11923, type (FHO, P), 21848 (P), 21856 (P), 36725 (FHO), 38741, leg. *Cherrier* (P); *Schmid* 2934 (P), 5010 (P); *Suprin* 2097 (NOU); *Veillon* 7296 (FHO), 7312 (FHO).

DERIVATION : *impolitus*, unpolished, alluding to the dull upper surface of the leaf (cf. *D. erudita*).

11. **Diospyros pustulata** F. White, *sp. nov.* — Fig. 6.

Inter species Novae-Caledoniae singularis ob folia parva, chartacea, marginibus valde recurvis (et in sicco et in vivo), ita ut folium quodque pustulam ruptam in calce Hominis sapientis referat.

Unique among New Caledonian species in its small chartaceous leaves with strongly recurved margins (both in the living plant and in dried specimens) so that each leaf looks like a burst blister on the heel of *Homo sapiens*.

TYPE : *Veillon* 6963, New Caledonia, Pouembout, 20 m, 11.10.1988, fr. (holo-, P; iso-, NOU).

Shrub or small tree up to 10 (15) m tall; bole up to 30 cm in diameter; bark black, rough, tessellated. Young branchlets densely puberulous; older branchlets slender, with grey or blackish rough bark. Leaves chartaceous, usually drying pale brownish-green; lamina up to 3×2 cm, elliptic or obovate-elliptic, apex rounded, margin strongly recurved even when fresh and the whole leaf looking like a large burst blister; lower surface almost glabrous to sparsely puberulous; lateral nerves in 3-6 pairs, venation reticulate, indistinct; petiole 0.1-0.2 cm long.

Male flower-buds 3-merous, subsessile in 1-3-flowered axillary fascicles and on older stems below the leaves, apparently similar to *D. parviflora* but much smaller. Female flowers unknown.

Fruits greenish-yellow, subsessile, solitary in axils of fallen leaves on older branchlets, subglobose or broadly ellipsoid, up to 1.5×1.2 cm, minutely puberulous. Fruiting calyx cup-shaped, \pm half as long as and slightly wider than the fruit, up to 0.8 cm long, sparsely and

minutely puberulous outside, tomentose inside, margin subentire, or indistinctly and irregularly 3-lobed, 0.1-0.15 cm thick, not reflexed.

Chromosome number : $2n = 30$.

DISTRIBUTION (Fig. 6) AND ECOLOGY : New Caledonia ; in dense coastal forest on limestone and alluvium from sea-level to 250 m on the western side of Grande-Terre.

MATERIAL STUDIED. — NEW CALEDONIA : *Guillaumin & Baumann-Bodenheim* 11094 (P, Z), 11123 (P, Z); *Jaffré* 2022 (NOU, P), 3116 (FHO); *MacKee* 24550 (FHO), 38743, leg. *Cherrier* (P), 39439, leg. *Cherrier* (P), 40981 (P), 43354 (P); *Suprin* 2132 (NOU); *Veillon* 3436 (NOU, P), 6664 (NOU), 6854 (NOU, P), 6963, type (NOU, P), 7384 (FHO).

DERIVATION : *pustula*, a low projection like a blister (see diagnosis above).

12. **Diospyros veillonii** F. White, *sp. nov.* — Fig. 1, 16.

Inter species Novae-Caledoniae quae in sectione Maba Bakh. includuntur singularis ob folia ingentia, fructus subglobosos, comparate parvos, et flores qui in annos singulos efferuntur inter axes inflorescentiae coralloidea persistentes in ramulis senioribus.

Among New Caledonian species belonging to Sectio *Maba* Bakh. unique in its huge leaves, relatively small tomentose fruits and in its flowers which are produced year after year among coralloid persistent inflorescence-axes on the older branchlets.

TYPE : *Veillon* 7202, New Caledonia, Paita, Baie de Gadji, 17.10.1989, ♀ fl. (holo-, P, sheet 1; iso-, P, sheet 2, FHO).

Shrub 3-4 m tall. Young branchlets glabrous, grey, slightly compressed when young; older branchlets closely set with black longitudinal striations. Leaves chartaceous, drying pale pinkish-brown below; lamina up to 19×8 cm, lanceolate-elliptic or oblong-elliptic, apex rounded, obtuse or bluntly subacuminate, base rounded or subtruncate, margin coarsely undulate and slightly to strongly revolute; lower surface glabrous; lateral nerves in ca. 10-12 pairs, clearly visible, usually slightly prominent beneath, venation reticulate, clearly visible on both surfaces but not very conspicuous; petiole 0.6-0.8 cm long.

Male flowers 3-merous, subsessile, produced year after year in clusters of up to 12 or more on short, coralloid inflorescence-axes on the older branchlets. Calyx 0.5×0.4 cm, much shorter than the corolla-tube, grey strigulose-tomentellous, lobes 0.25 cm long, deltate. Corolla 1.1 cm long, strigose, lobes 0.3 cm long. Female flowers borne as in male but in fewer-flowered clusters. Calyx longer than the corolla-tube, 1.1×0.6 cm, grey-strigulose-tomentellous, lobes 0.4 cm long. Corolla 1.4 cm long, strigose, lobes 0.5 cm long.

Fruits globose, 1.5×1.5 cm, tomentellous. Fruiting calyx cup-shaped, slightly wider than the fruit, 1 cm long, tomentellous outside, more sparsely hairy inside, indistinctly 3-lobed, margin 0.2 cm thick, not or only slightly recurved.

DISTRIBUTION (Fig. 1) AND ECOLOGY : New Caledonia ; only known from the type locality on the west coast of Grande-Terre. It grows in coastal sclerophyllous forest on a black clay soil.

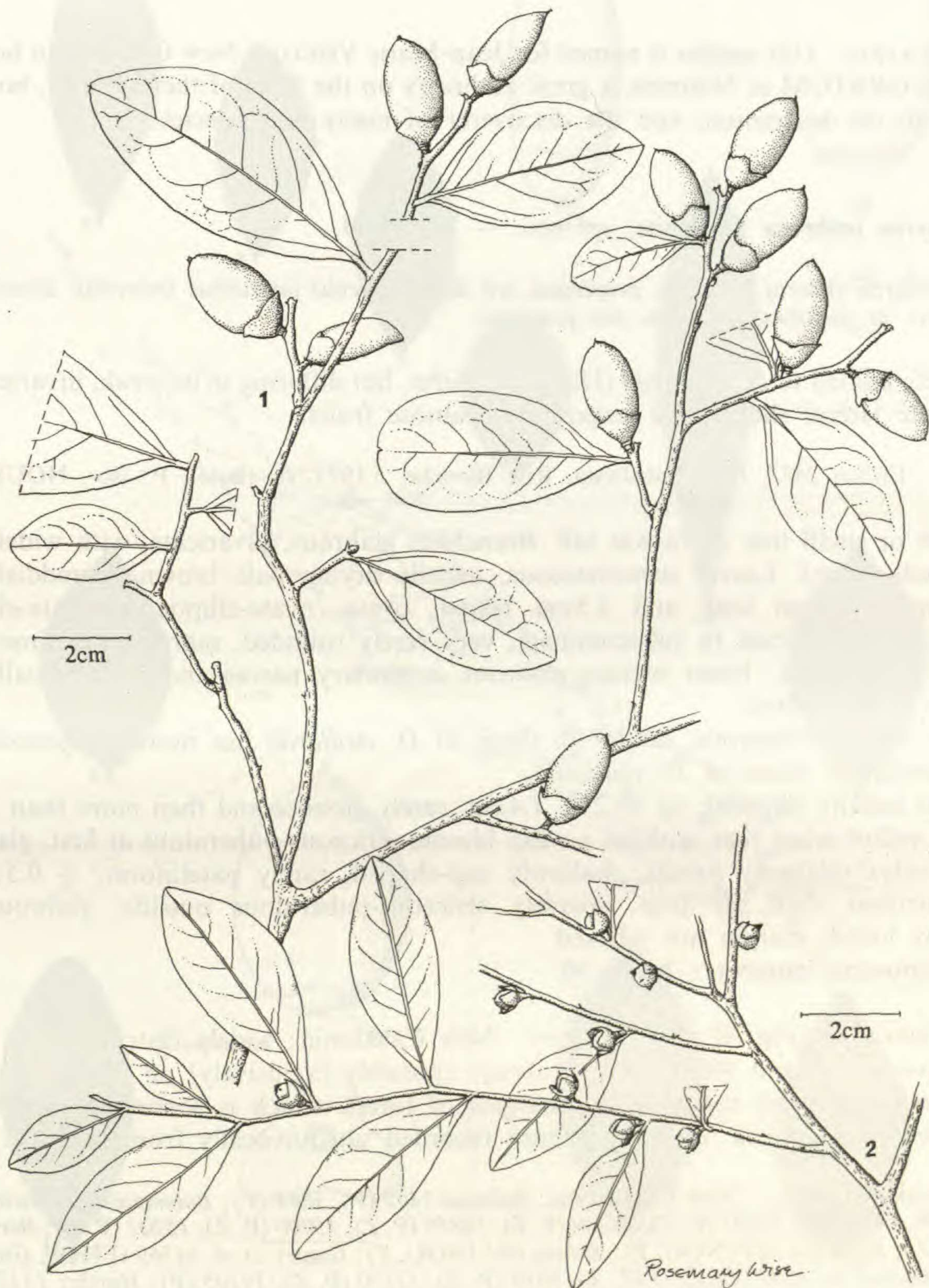


Fig. 8. — *Diospyros umbrosa* F. White : 1, branchlet with fruits (Schmid 5266, leg. Sévenet). — *D. tridentata* F. White : 2, branchlet with immature fruits (MacKee 26478).

MATERIAL STUDIED. — NEW CALEDONIA : *Veillon* 7202, type (FHO, P), 7203 (FHO, P), 7429 (FHO, P).

DEDICATION : This species is named for Jean-Marie VEILLON, New Caledonian botanist at the Centre ORSTOM in Nouméa, a great authority on the flora of the territory, both in the field and in the herbarium, and the discoverer of many new species.

13. **Diospyros umbrosa** F. White, *sp. nov.* — Fig. 8, 9.

D. vieillardii (Hiern) Kosterm. *propinqua*, sed differt surculis lateralibus imbecillis, divaricatis, non subfastigiatis, et fructibus grandibus, non pruinosis.

Closely related to *D. vieillardii* (Hiern) Kosterm. but differing in its weak, divaricate, non-subfastigiate lateral shoots and larger non-pruinose fruits.

TYPE : *Veillon* 2877, New Caledonia, Riv. Blanche, 5.1973, fr. (holo-, P; iso-, NOU).

Shrub or small tree up to 6 m tall. Branchlets glabrous, divaricate, with widely spaced leaves. Buds naked. Leaves subcoriaceous, usually drying pale brown or reddish-brown; lamina up to 11 cm long and 3.5 cm broad, ovate, ovate-elliptic, obovate-elliptic or oblanceolate, apex acute to subacuminate, very rarely rounded, margin sometimes slightly recurved or undulate; lower surface glabrous, secondary nerves and veins usually clearly visible on both surfaces.

Male flowers trimerous, similar to those of *D. vieillardii* but more congested. Female flowers similar to those of *D. vieillardii*.

Fruits usually ellipsoid, up to 2×1.4 cm, rarely globose and then more than 1.2 cm in diameter, yellow when ripe, without a waxy bloom, sericeous-puberulous at first, glabrescent. Fruiting calyx relatively robust, shallowly cup-shaped, rarely patelliform, ± 0.5 cm long, much narrower than the fruit, sparsely sericeous-puberulous outside, glabrous inside, indistinctly lobed, margin not reflexed.

Chromosome number : $2n = 30$.

DISTRIBUTION (Fig. 9) AND ECOLOGY : New Caledonia; widely distributed on Grande-Terre between 150 and 900 m, almost always (possibly exclusively) on ultrabasic rocks. It grows inside and more rarely at the margins of forest, which is sometimes dominated by *Nothofagus* or *Araucaria*. It has not been recorded unequivocally from maquis.

MATERIAL STUDIED. — NEW CALEDONIA : *Balansa* 1462 (P), 3644 (P); *Baumann-Bodenheim* 8204 (P, Z), 8270 (P), 14105 (Z), 14165 (P, Z), 14230 (P, Z), 14859 (P, Z), 15090 (P, Z), 15202 (P, Z); *Bernardi* 9526 (G, K, P, Z); *Blanchon* 444 (NOU, P); *Brinon* 684 (NOU, P); *Gentry et al.* 34569 (FHO); *Guillaumin & Baumann-Bodenheim* 8597 (P), 8725 (P, Z), 8919 (P, Z), 11870 (P, Z), 14105 (P); *Hartley* 15121 (NOU); *Hoff* 542 (NOU), 781 (NOU), 3372 (NOU); *Hürlimann* 268 (P), 313 (P, Z), 1617 (P, Z), 1638 (P, Z), 3412 (G, Z); *Jaffré* 1148 (NOU, P), 1769 (NOU, P), 2385 (NOU, P), 2663 (P), 2711 (NOU, P); *MacKee* 4548 (K, P), 12921 (P), 24013 (P), 24678 (FHO), 29090 (FHO), 29177 (FHO), 33418 (P), 43846 (P), 45003 (P); *McPherson* 2017 (FHO, MO, P), 2144 (FHO, P), 2628 (FHO, P), 3647 (FHO, P), 4132 (FHO, P), 5700 (FHO, MO, P), 5763 (FHO, MO, P), 6107 (FHO, MO, P), 6403 (FHO, MO, P); *Schmid* 839 (NOU, P),

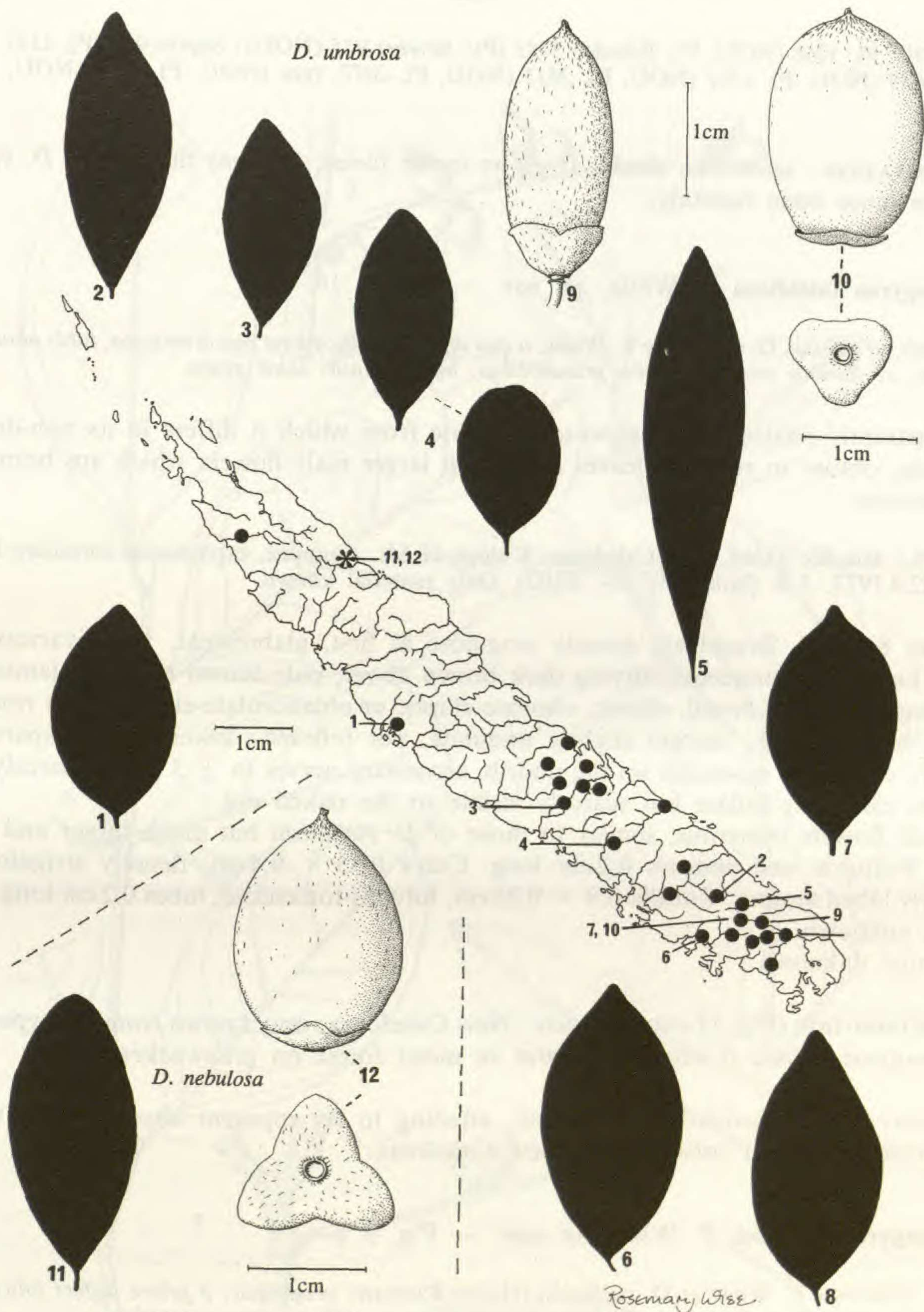


Fig. 9. — *Diospyros umbrosa* F. White : 1-8, leaves selected to show the range of variation in shape and size of the species; 9, fruit; 10, fruit and fruiting calyx seen from below (1, Jaffré 1769; 2, MacKee 29090; 3, MacKee 24678; 4, Hoff 3372; 5, McPherson 5763; 6, McPherson 2628; 7, Hartley 15121; 8, MacKee 43846; 9, Sévenet 915; 10, Blanchon 444). — *D. nebulosa* F. White : 11, a typical leaf; 12, fruit and fruiting calyx seen from below (11, 12, Schmid 1523).

2739 (NOU, P), 5266 (NOU, P); *Schodde* 5241 (P); *Sévenet* 915 (NOU); *Suprin* 996 (P), 1537 (NOU); *Veillon* 1038 (NOU, P), 1701 (NOU, P), 2815 (NOU, P), 2877, type (NOU, P), 4367 (NOU, P), 6746 (NOU).

DERIVATION : *umbrosus*, shady. It grows inside forest, whereas the related *D. vieillardii* grows in more open habitats.

14. **Diospyros fastidiosa** F. White, *sp. nov.* — Fig. 1, 16.

Affinis, ut videtur, D. umbrosae F. White, *a qua differt ramificatione non divaricata, foliis obtusis usque rotundatis, et floribus masculis multo grandioribus, inflorescentiis laxis gestis.*

Apparently related to *D. umbrosa* F. White from which it differs in its non-divaricate branching, obtuse to rounded leaves and much larger male flowers which are borne in lax inflorescences.

TYPE : *MacKee* 25369, New Caledonia, E slope of Mt. Aoupinié, exploitation forestière Devillers, 600 m, 22.4.1972, ♂ fl. (holo-, P; iso-, FHO). Only material known.

Tree 8 m tall. Branchlets densely strigulose at first, glabrescent, not divaricate. Buds naked. Leaves subcoriaceous, drying dark brown above, pale brown beneath; lamina up to 8 cm long and 3.5 cm broad, elliptic, obovate-elliptic or oblanceolate-elliptic, apex rounded or obtuse, base cuneate; margin slightly undulate, not reflexed; lower surface sparsely and minutely strigulose, especially on the midrib, secondary nerves in ± 5 pairs, scarcely visible, venation closely reticulate but scarcely visible to the naked eye.

Male flowers trimerous, similar to those of *D. vieillardii* but much larger and in laxer cymes. Peduncle and pedicels 0.2 cm long. Calyx 0.35×0.4 cm, densely strigulose, very shallowly lobed at apex. Corolla 0.9×0.35 cm, fulvous-tomentose, lobes 0.2 cm long. Female flowers unknown.

Fruits unknown.

DISTRIBUTION (Fig. 1) AND ECOLOGY : New Caledonia; only known from the type-locality, Mt. Aoupinié, where it occurs at 600 m in moist forest on grauwackes.

DERIVATION : *fastidiosus*, squeamish, alluding to its apparent absence from the most widespread geological substrates in New Caledonia.

15. **Diospyros nebulosa** F. White, *sp. nov.* — Fig. 9.

D. umbrosae F. White *et D. vieillardii* (Hiern) Kosterm. *propinqua*; *a priore differt foliis coriaceis, rotundatis, evenosis, a posteriore fructibus grandioribus, superficie cerea carentibus.*

Closely related to *D. umbrosa* F. White and *D. vieillardii* (Hiern) Kosterm., but differing from the former in its coriaceous, rounded, evenose leaves and from the latter in its larger fruits which lack a waxy covering.

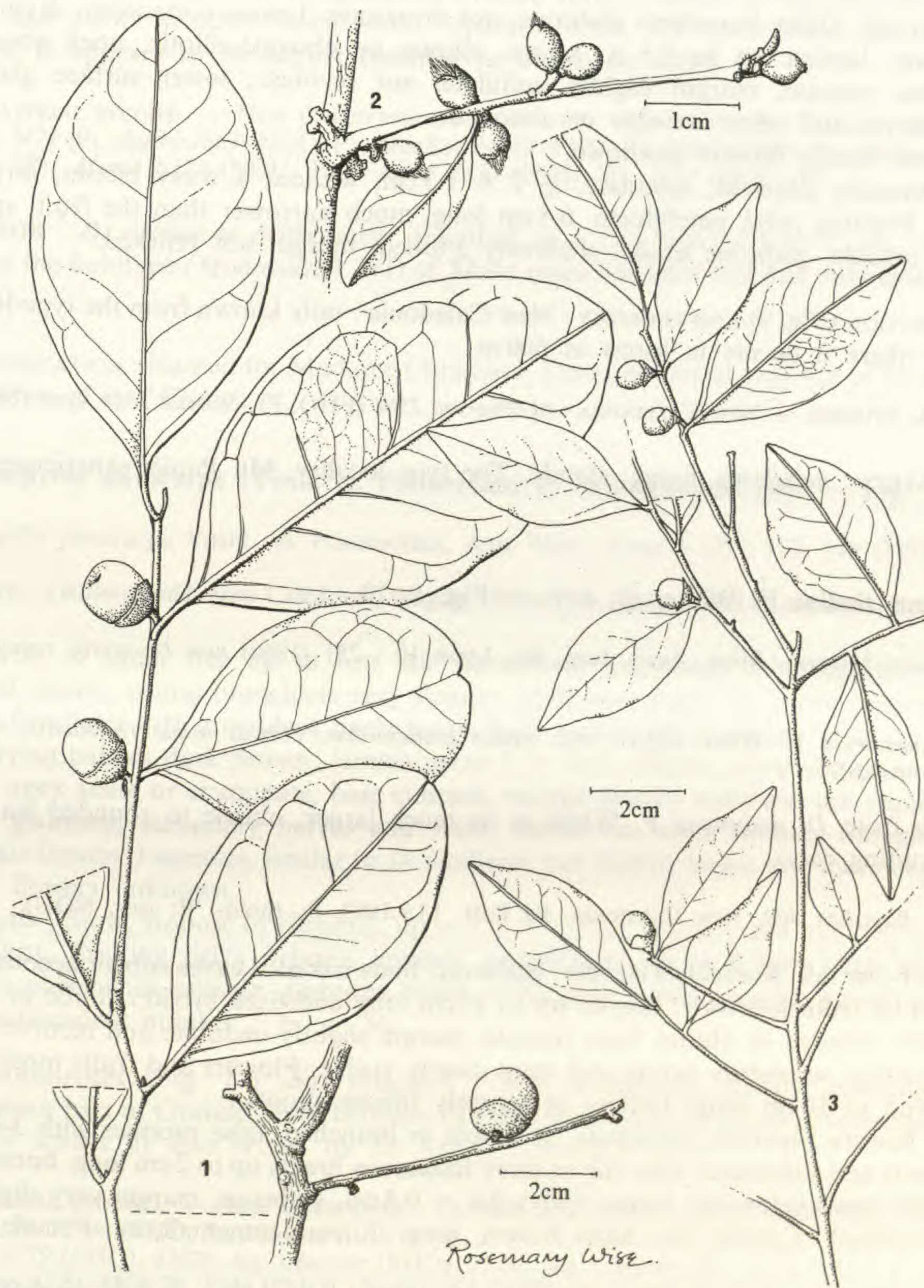


Fig. 10. — *Diospyros tireliae* F. White : 1, branchlets with fruits; 2, male inflorescence (1, *Blanchon* 409; 2, *Veillon* 2120). — *D. flavocarpa* (Vieillard ex *Parmentier*) F. White : 3, branchlet with fruits (*MacKee* 32920).

TYPE : *Schmid 1523*, New Caledonia, Mt. Panié, 600 m, 20.9.1966, fr. (holo-, P; iso-, NOU).

Tree 6 m tall. Older branchlets glabrous, not divaricate. Leaves coriaceous, drying pale reddish-brown; lamina up to 7.5×3.5 cm, elliptic or obovate-elliptic, apex obtuse or rounded, base cuneate, margin slightly undulate, not revolute; lower surface glabrous, secondary nerves and veins invisible or almost so.

Male and female flowers unknown.

Fruits broadly ellipsoid, apiculate, $\pm 2 \times 1.3$ cm, without a waxy bloom, sericeous-puberulous. Fruiting calyx patelliform, 0.5 cm long, much narrower than the fruit, sparsely puberulous outside, glabrous inside, shallowly 3-lobed, margin not reflexed.

DISTRIBUTION (Fig. 9) AND ECOLOGY : New Caledonia : only known from the type-locality, Mt. Panié, where it occurs in forest at 600 m.

MATERIAL STUDIED. — NEW CALEDONIA : *McPherson 2564* (FHO, P); *Schmid 1523*, type (NOU, P).

DERIVATION : *nebulosus*, foggy, cloudy. The type locality, Mt. Panié, experiences much cloud.

16. **Diospyros tireliae** F. White, *sp. nov.* — Fig. 1, 10.

— *Maba rosea* MONTR., Mém. Acad. Imp. Sci. Lyon 10 : 231 (1860) *non Diospyros rosea* GÜRKE (1913).

A D. nemorosa F. White *differt foliis multo grandioribus, obtusis usque rotundatis, et calyce fructificante truncato.*

Differs from *D. nemorosa* F. White in its much larger, obtuse to rounded leaves and truncate fruiting calyx.

TYPE : *Blanchon 409*, New Caledonia, Ile Pott, 13.9.1963, fr. (holo-, P; iso-, NOU).

Shrub 1-2 m tall. Branchlets slender, glabrous. Buds naked. Leaves subcoriaceous, drying pale brown or reddish-brown; lamina up to 13 cm long and 6 cm broad, elliptic or oblong-elliptic, apex rounded or obtuse, base cuneate, margin slightly undulate and recurved; lower surface glabrous, secondary nerves and veins clearly visible. Flowers and fruits mostly borne on short (up to 10 cm long) leafless or sparsely foliose shoots.

Male flowers 3-merous, subsessile, in simple or branched, false racemes with 3-6 (rarely more) flowers and sometimes with one or more foliaceous bracts up to 2 cm long, borne mainly on the older stems below the leaves. Calyx 0.3×0.4 cm, glabrous, margin very slightly and irregularly lobed. Corolla (in bud) 0.6 cm long, fulvous-tomentellous. Female flowers unknown.

Fruits subglobose to very broadly ellipsoid, up to 1.5×1.3 cm, yellow or orange when ripe, sparsely and minutely puberulous. Fruiting calyx cup-shaped, up to 0.6 cm long, narrower or very slightly wider than the fruit, glabrous except for a few minute hairs outside, glabrous inside, margin truncate, not reflexed.

DISTRIBUTION (Fig. 1) AND ECOLOGY : New Caledonia; only known from Ile Pott and Ile Art and two widely separated localities on Grande-Terre. It occurs at altitudes between 50 and 400m and grows in dense moist forest, riparian forest, low dense forest and tall shrubby maquis. It appears to be almost confined to ultrabasic rocks.

MATERIAL STUDIED. — NEW CALEDONIA : *Blanchon* 409, type (NOU, P); *Cabalion* 669 (NOU, P); *Debray* 2471 (P); *Jaffré* 1563 (NOU, P); *MacKee* 24410 (FHO, P), 30467 (FHO, P); *Montrouzier* 141 (G, P), *s.n.* (P); *Morat* 6223 (NOU, P); *Veillon* 2120 (NOU, P), 2712 (NOU, P).

NOTE : *D. tireliae* is deliberately described as a new species with a new type. This is because the holotype (*Montrouzier* 141) of *Maba rosea* has been lost and only small fragments remain.

DEDICATION : Named for Madame Christiane TIREL, botanical explorer of New Caledonia and editor of its 'Flora'.

17. *Diospyros flavocarpa* (Vieill. ex Parmentier) F. White, *comb. nov.* — Fig. 10, 11.

— *Cargillia flavocarpa* VIEILL. ex PARMENTIER, Ann. Univ. Lyon 6 (2) : 112, 149 (1892).

TYPE : *Vieillard* 2864, New Caledonia, Wagap, 1861-67, fr. (holo-, LILLE, not seen; iso-, BM, K, P).

Shrub or small tree up to 6m tall. Branchlets ascending, subfastigate, with rather crowded leaves; young branchlets very slender, glabrous except for a few minute strigulose hairs at first, later with grey-black finely striate bark. Leaves chartaceous, rarely coriaceous (Ile Art), drying pale or dark brown; lamina up to 7 × 3 cm, elliptic, ovate-elliptic or lanceolate-elliptic, apex acute or acuminate, base cuneate, margin usually undulate, not recurved; lower surface glabrous, secondary nerves and veins, visible on lower surface, though indistinct.

Male flowers 3-merous, similar to *D. vieillardii* but slightly larger and more densely hairy. Female flowers unknown.

Fruits yellow, globose or ellipsoid, up to 1.5 × 1.2 cm, sparsely and minutely puberulous, glabrescent. Fruiting calyx delicate, minute, patelliform, up to 0.3 cm long, sparsely and minutely puberulous outside, glabrous inside, indistinctly lobed, margin sometimes reflexed.

Chromosome number : $2n = 30$.

DISTRIBUTION (Fig. 11) AND ECOLOGY : New Caledonia; widely distributed in the northeastern part of Grande-Terre between 20 and 950 m, where it grows in forest and riparian forest on schists. It also occurs on Ile Art on ultrabasic rocks.

MATERIAL STUDIED. — NEW CALEDONIA : *Dickison* 285 (NOU); *Jaffré* 1646 (NOU, P); *MacKee* 10007 (L, P), 17746 (FHO, P), 19168 (P), 20818 (P), 24586 (FHO), 28438 (FHO), 29251 (FHO, P), 31628 (FHO), 32779 (FHO), 32920, leg. *Cherrier* (FHO), 35293, leg. *Cherrier* (P), 36738 (FHO, P), 39327 (P); *McPherson* 4520 (MO, P), 5246 (FHO); *Nothis* 265 (NOU, P); *Suprin & Berger* 2357 (NOU, P); *Tirel* 1281 (P); *Veillon* 5745 (NOU), 5748 (NOU, P); *Vieillard* 2864, type (BM, K, LILLE, not seen, P); *Viot* 777 (P).

DERIVATION : *flavus*, yellow; *carpus*, fruit.

18. **Diospyros calciphila** F. White, *sp. nov.* — Fig. 11, 12.

A. D. umbrosa F. White *differt foliis coriaceis, rotundatis vel obtusis, crebre venosis, et calyce fructificante multo crassiore, cinereo-tomentelloso.*

Differs from *D. umbrosa* F. White in its coriaceous, rounded or obtuse, closely venose leaves and much thicker grey-tomentellous fruiting calyx.

TYPE : *Schmid 661*, New Caledonia, Lifou, Hapetra, 31.8.1965, fr. (holo-, P; iso-, NOU).

Shrub or small tree up to 8 m tall. Branchlets with rough, blackish bark, ascending and subfastigate or repeatedly and densely forked. Leaves coriaceous, drying pale reddish-brown; lamina up to 7×4.5 cm, usually much smaller, elliptic, obovate-elliptic or ovate-elliptic, apex rounded or obtuse, base cuneate to broadly obtuse, margin slightly undulate and recurved; lower surface glabrous, venation very closely reticulate, usually clearly visible.

Male flowers 3-merous, subsessile in 3-7-flowered, shortly pedunculate fascicles, similar to *D. minimifolia* but calyx more deeply lobed. Female flowers unknown.

Fruits yellow, broadly ellipsoid, $\pm 1.2 \times 1$ cm, sericeous-tomentellous when young, glabrescent in patches. Fruiting calyx robust, shallowly cup-shaped, wider than the fruit, 0.6-0.7 cm long and 0.1-0.15 cm thick, persistently grey-tomentellous outside, sericeous-tomentose in upper half inside otherwise sparsely and minutely puberulous, margin indistinctly 3-lobed.

DISTRIBUTION (Fig. 11) AND ECOLOGY : New Caledonia; widely distributed in the Loyalty Islands and the Ile des Pins. It occurs from near sea-level to 150 m, and grows in forest and scrub, mainly on coral limestone or alluvium, but in the Ile des Pins it also has been recorded from serpentine.

MATERIAL STUDIED. — NEW CALEDONIA : *Balansa 2481* (P); *Baumann-Bodenheim 13600* (P), *13611* (P), *13854* (P, Z), *14694* (P), *14768* (P, Z), *14784* (P, Z); *Bergeret 102* (P); *Bernardi 10081* (L, P, Z); *Cheesman 3324* (BM); *Däniker 2070 A* (P), *2451* (P, Z), *2501* (P, Z), *2501 A* (P); *Debray 2437* (P); *Deplanche 44* (P); *Franc 1037* (P); *Hoff 1325* (NOU), *2386* (NOU, P); *Home s.n.* (BM); *Jaffré 2071* (NOU, P); *MacKee 5038* (L, P), *13090* (P), *14050* (P), *15553* (P), *15565* (P), *25437* (FHO), *27187* (FHO), *28216* (FHO), *43523*, leg. *Cherrier* (P); *McPherson 4879* (FHO), *6613* (MO, P); *Milne 12* (K); *Schmid 661*, type (NOU, P); *Schmid, R. & Phillips s.n.*, 1978-80 (K, P); *Veillon 6332* (NOU); *Virost 995* (P), *1000* (P), *1062* (P), *1079* (P); *Webster 18367* (P).

DERIVATION : From Greek, lime-loving.

19. **Diospyros minimifolia** F. White, *sp. nov.* — Fig. 11, 16.

D. calciphilae F. White *propinqua, sed differt ramulis gracillimis, foliis minoribus, fructibus multo minoribus et calyce fructificante minus robusto.*

Closely related to *D. calciphila* F. White but differing in its very slender branchlets, smaller leaves, much smaller fruits and less robust fruiting calyx.

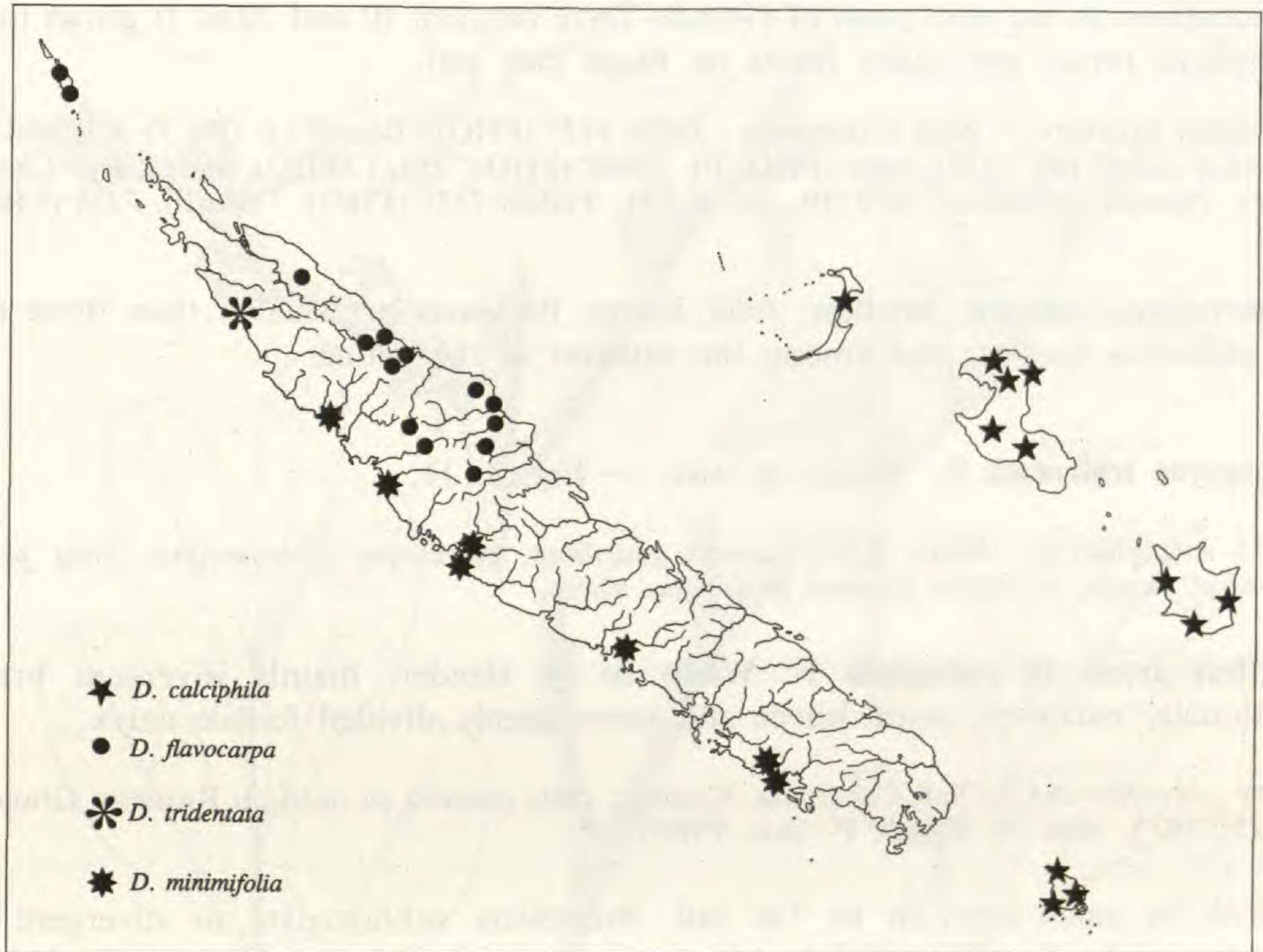


Fig. 11. — Distribution of 4 species of **Diospyros**.

TYPE : MacKee 24551, New Caledonia, Pouembout, 30 m, 16.2.1972, fr. (holo-, P; iso-, FHO).

Shrub or small tree up to 8 m tall. Branchlets usually divergent, very slender, minutely puberulous at first, later with grey-black, finely striate bark. Leaves subcoriaceous, drying pale to dark brown, brownish-green or pale green; lamina $1 \times 1-3.5 \times 2$ cm, suborbicular to obovate or broadly elliptic, apex rounded or obtuse, margin slightly undulate and recurved; lower surface glabrous, lateral nerves and veins usually scarcely visible.

Male flowers 3-merous, in 2-3-flowered, very shortly pedunculate fascicles. Calyx 0.2 cm long, sparsely grey-strigulose, very shallowly lobed. Corolla 0.5 cm long (in bud), setulose-tomentellous. Female flowers solitary, subsessile. Calyx 0.3 cm long, almost as long as the glabrous corolla-tube, strigulose-tomentellous, shallowly lobed. Corolla 0.5 cm long, lobes 0.2 cm long, setulose-tomentellous.

Fruits yellow, globose or depressed-globose, up to 0.8×0.8 cm, minutely tomentellous, glabrescent in patches. Fruiting calyx patelliform or shortly cup-shaped, slightly narrower than the fruit, delicate, ± 0.45 cm long and 0.05 cm thick, densely puberulous outside, glabrous inside except near the shallowly but distinctly 3-lobed margin.

Chromosome number : $2n = 30$.

DISTRIBUTION (Fig. 11) AND ECOLOGY : New Caledonia; only known from a few widely spaced localities on the west coast of Grande-Terre between 10 and 70 m. It grows in coastal sclerophyllous forest and valley forest on black clay soil.

MATERIAL STUDIED. — NEW CALEDONIA : *Jaffré* 3117 (FHO); *Lécard* s.n. (P), 33 *A* (Catal. No. 21) (P); *MacKee* 23830 (P), 24551, type (FHO, P), 24998 (FHO), 25013 (FHO), 39433, leg. *Cherrier* (P), 41376 (P); *Pancher* (*Vieillard*) 2879 (P), s.n. (K, P); *Veillon* 7158 (FHO), 7206 (P), 7378 (FHO), 7389 (FHO).

DERIVATION : *minime*, smallest; *folia*, leaves. Its leaves are smaller than those of other New Caledonian species, and among the smallest in the genus.

20. **Diospyros tridentata** F. White, *sp. nov.* — Fig. 8, 11.

A D. calciphila F. White *differt ramulis gracilibus, plerumque divergentibus, foliis proportione angustioribus, acutis, et calyce femineo profundius diviso.*

Differs from *D. calciphila* F. White in its slender, mainly divergent branchlets, proportionally narrower, acute leaves and more deeply divided female calyx.

TYPE : *MacKee* 26478, New Caledonia, Koumac, crête calcaire au nord du Ruisseau Grande Forêt, 250 m, 25.3.1973, imm. fr. (holo-, P; iso-, FHO).

Shrub or small tree up to 7 m tall. Branchlets subfastigate or divergent. Leaves subcoriaceous, drying pale reddish-brown; lamina up to 5 × 2 cm, narrowly elliptic, obovate-elliptic or oblanceolate-elliptic, apex acute to subacuminate, base narrowly cuneate, margin not or only very slightly undulate; lower surface glabrous, venation closely reticulate but not very prominent.

Male flowers (in bud) similar to *D. minimifolia* but calyx more deeply lobed. Female flowers similar to *D. minimifolia* but slightly larger and calyx more deeply lobed and longer than the corolla-tube.

Fruits (immature) globose. Fruiting calyx cup-shaped, wider than the fruit.

DISTRIBUTION (Fig. 11) AND ECOLOGY : New Caledonia; only known from a few localities at 200-250 m near Koumac. It grows in degraded forest and low forest on rocky calcareous ridges.

MATERIAL STUDIED. — NEW CALEDONIA : *MacKee* 26478, type (FHO, P), 34153 (FHO), 36516 (FHO).

DERIVATION : *tridentatus*, with 3 teeth, referring to the calyx of the female flower.

21. **Diospyros cherrieri** F. White, *sp. nov.* — Fig. 1, 12.

A D. vieillardii (Hiern) Kosterm. *differt foliis obovato-emarginatis, ramulis profunde sulcatis, et alabastris femineis fere sex bracteis grandibus squamiformibus munitis.*

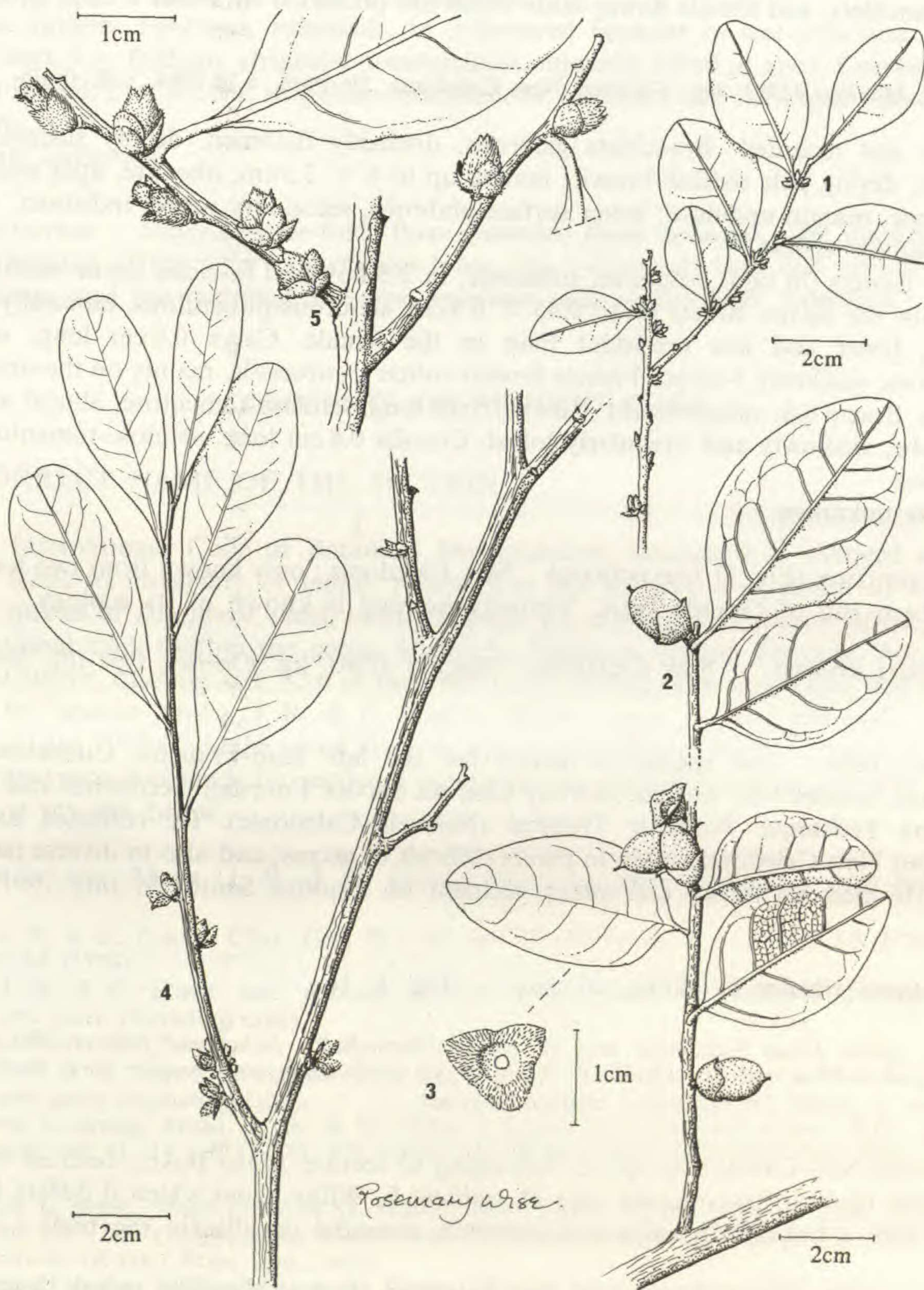


Fig. 12. — *Diospyros calciphila* F. White : 1, branchlet with male flower-buds; 2, branchlet with fruits; 3, fruiting calyx seen from above (1, *Daniker 2501 A*; 2, 3, *MacKee 15553*). — *D. cherrieri* F. White : 4, branchlet with male flower-buds; 5, female flowers (4, *Schmid 1606*; 5, *MacKee 42303*, leg. *Cherrier*).

Differs from *D. vieillardii* (Hiern) Kosterm. in its obovate-emarginate leaves, deeply sulcate branchlets, and female flower-buds which are protected by about 6 large squamiform bracts.

TYPE : *MacKee 42303*, leg. *Cherrier*, New Caledonia, Ile Pam, 4.10.1984, ♀ fl. (holo-, P).

Habit not recorded. Branchlets glabrous, distinctly flattened, deeply sulcate. Leaves coriaceous, drying pale reddish-brown; lamina up to 6×3.5 cm, obovate, apex emarginate, base cuneate, margin undulate; lower surface glabrous, secondary nerves indistinct, venation not or scarcely visible.

Male flowers (in bud) 3-merous, subsessile, in 2-5-flowered fascicles borne mainly on the stems below the leaves. Bracts up to 0.45×0.4 cm, sericeous-puberulous, especially towards the apex, fewer and less persistent than in the female. Calyx 0.6 cm long, sericeous-tomentellous, shallowly 3-lobed. Female flowers solitary, subsessile, mainly on the stems below the leaves. Bracts 6-8, subpersistent. Calyx 0.5 cm long, setulose-tomentose, almost as long as corolla-tube, shallowly and irregularly lobed. Corolla 0.8 cm long, setulose-tomentose, lobes 0.2 cm long.

Fruits unknown.

DISTRIBUTION (Fig. 1) AND ECOLOGY : New Caledonia; only known from two localities at the northern end of Grande-Terre. Virtually nothing is known of its ecology.

MATERIAL STUDIED. — NEW CALEDONIA : *MacKee 42303*, leg. *Cherrier*, type (P); *Schmid 1606* (NOU).

DEDICATION : This species is named for the late Jean-François CHERRIER, a New Caledonian forester who was successively Chef du Service Forestier Territorial and Directeur du Centre Technique Forestier Tropical (Nouvelle-Calédonie). He collected assiduously throughout New Caledonia, often in places difficult of access, and also in diverse parts of the Pacific. He died on service (aeroplane accident on Espiritu Santo) in July 1991.

22. *Diospyros trisulca* F. White, *sp. nov.* — Fig. 1, 16.

Inter species Novae Caledoniae quae in sectione Maba Bakh. includuntur propter folia grandissima confundi potest solum cum D. veillonii F. White, a qua facile distinguitur propter flores masculos calyce botuliformi et corolla (in alabastro) anguste conoidea.

Among New Caledonian species belonging to section *Maba* Bakh., because of its large leaves only likely to be confused with *D. veillonii* F. White, from which it differs in its male flowers with a botuliform calyx and narrowly conoidal corolla (in the bud).

TYPE : *Veillon, Tirel & Jérémie 7446*, New Caledonia, Ouégoa, Mandjélia, près de l'ancienne scierie vers 600 m, in dense forest, 11.12.1991, ♂ fl. (holo-, P; iso-, FHO). Only material known.

Tree 12 m tall. Branchlets blackish, strigulose. Leaves coriaceous, drying dull green or pale reddish-brown; lamina up to 16×7 cm, oblong-elliptic, apex shortly and bluntly

acuminate, base cuneate or rounded; lower surface very sparsely strigulose, secondary nerves indistinct in ca. 12 pairs, venation inconspicuous.

Male flowers 3-merous, subsessile, in 3-flowered fascicles in leaf-axils and below the leaves. Calyx 1×0.25 cm, strigulose-tomentellous, minutely lobed at apex. Corolla narrowly conoidal in bud, 2×0.2 cm, strigulose-tomentellous, lobed for half its length. Female flowers unknown.

Fruits unknown.

DERIVATION : *trisulca*, three-fold, three pointed, three pronged. The epithet is triply apposite because of the 3 very short calyx-lobes, the 3 extremely long and narrowly deltate, corolla-lobes, and the fact that the type specimen was collected by 3 persons.

COMMENTS ON SECTION *MABA*

THE CORRECT NAME OF THE SECTION

The International Code of Botanical Nomenclature, because it is changed at regular intervals leads to instability of names rather than the stability it is meant to foster.

The species of *Diospyros* which in this account are attributed to section *Maba* were first given sectional rank (within the genus *Maba*) by HIERN as section *Ferreola*. According to R. K. BRUMMITT, quoting Art. 32.6 of the 1988 Code dealing with autonoms, this should be replaced by 'section *Maba* (J. R. & G. FORST.) HIERN' (pers. comm.) although, under the provision of the 1978 Code the name *Ferreola* was correct. Before the publication of the 1978 Code no provision was made for sectional autonoms. An attempt to summarize this awkward situation is set out below.

***Diospyros* L. sect. *Maba* (J. R. & G. Forst.) Hiern (as sect. *Ferreola* — see below).**

- *Maba* J. R. & G. FORST., Char. Gen. Pl. : 61, *tab. 61* (1775); ed. 2 : 121, *tab. 61* (1776); ed. 3 : 61, *tab. 61* (1776).
- *Maba* J. R. & G. FORST. sect. *Ferreola* (ROXB.) HIERN, Trans. Cambridge Phil. Soc. 12 : 107 (1873) *pro parte* (including type).
- *Ferreola* ROXB., Pl. Corom. 1 : 35, *tab. 45* (1795).
- *Maba* J. R. & G. FORST. sect. *Macreightia* (A.DC.) HIERN, Trans. Cambridge Phil. Soc. 12 : 107 (1873) *pro parte* (excluding type).
- *Diospyros* L. [subg. *Maba* (J. R. & G. FORST.) BAKH.] sect. *Forsteria* BAKH., Bull. Jard. Bot. Buitenzorg, ser. 3, 15 : 8 (1937), 428 (1941); F. WHITE, Bull. Jard. Bot. Nat. Belg. 50 : 450 (1980).
- *Diospyros* L. [subg. *Maba* (J. R. & G. FORST.) BAKH.] sect. *Ferreola* (ROXB.) FOSB., Bull. Torrey Bot. Club 65 : 609 (1939); *sensu* BAKH., Bull. Jard. Bot. Buitenzorg, ser. 3, 15 : 429 (1941) as sect. *Ferreola* (ROXB.) FOSB. *sens. strict.*
- *Diospyros* L. [subg. *Maba* (J. R. & G. FORST.) BAKH.] sect. *Cupulifera* FOSB., Bull. Torrey Bot. Club 65 : 613 (1939); BAKH., Bull. Jard. Bot. Buitenzorg, ser. 3, 15 : 444 (1941), *syn. nov.*
- *Diospyros* L. [subg. *Maba*] sect. *Maba*; P. S. GREEN, Kew Bull. 23 : 339 (1969).

Some further comments can be found in the next section.

THE TAXONOMIC HISTORY OF SECTION *MABA*

It begins with the publication of the new genus *Maba* by J. R. & G. FORSTER (1775). *Maba* is based on *M. elliptica* which the FORSTERS collected in Tonga on COOK's second voyage. They mention that it is known to the local people as 'Maba', and is planted by them on Tongatapu (Tonga-tabu) and Nomuka (Namoka). There is a FORSTER specimen presumably from one of these islands in the British Museum (GREEN, 1969 : 340), which A. C. SMITH (1981 : 732) cites as a lectotype.

Robert BROWN (1810) in his 'Prodromus' described from Australia 7 new species of *Maba* (*M. compacta*, *M. geminata*, *M. humilis*, *M. laurina*, *M. littorea*, *M. obovata* and *M. reticulata*), which he had collected himself on his voyage with FLINDERS. They all belong to *Maba sensu stricto*.

LABILLARDIÈRE (1824) described two specimens which he had collected on the 'Voyage à la recherche de LA PÉROUSE'. He made one the type of a new species, *M. rufa* Labill. and referred to the other as '*M. elliptica*'. The inflorescences of the latter, however, appear to be galled, and its identity is still uncertain. It is not conspecific with true *M. elliptica*.

In the first effective monograph of *Ebenaceae*, A. de CANDOLLE (1844) included in *Maba* 17 species of which only *M. rufa* occurs in New Caledonia. *Maba* as circumscribed by de CANDOLLE extends from West Africa (Sierra Leone and Ghana) to Hawaii and Tonga. Except for a few subsequently described species, de CANDOLLE's concept of *Maba* corresponds exactly to its present circumscription as a section of *Diospyros*. His monograph is a beacon in the taxonomic history of the *Ebenaceae* and his treatment of *Maba* is superior to anything which has followed.

In the second and most recent worldwide monograph of *Ebenaceae*, HIERN (1873) greatly expanded earlier concepts of *Maba*. He included 59 species, more than half of which are not at all closely related to *Maba sensu* A. de CANDOLLE. HIERN divided *Maba* into 6 sections, of which the first, section *Ferreola* (Roxb.) Hiern (which ought to be called section *Maba* (J. R. & G. Forst.) Hiern), apart from some discordant elements, corresponds closely to A. de CANDOLLE's circumscription of *Maba*. HIERN included all of de CANDOLLE's species, reducing some to synonymy. Of the 24 species in HIERN's *Ferreola*, the following truly belong : *M. andersonii* Sol. ex Hiern, *M. buxifolia* Pers., *M. compacta* R. Br., *M. diffusa* Hiern, *M. elliptica* J. R. & G. Forst., *M. foliosa* Rich ex A. Gray, *M. geminata* R. Br., *M. hemicycloides* F. Muell. ex Benth., *M. hillebrandii* Seem., *M. humilis* R. Br., *M. laurina* R. Br., *M. major* G. Forst., *M. nigrescens* Dalz., *M. obovata* R. Br., *M. reticulata* R. Br., *M. rufa* Labill., *M. sandwicensis* A. DC. and *M. vieillardii* Hiern, as do *M. lanceolata* (Poir.) Hiern, *M. natalensis* Harv. and *M. seychellarum* Hiern which HIERN included in section *Macreightia* (A. DC.) Hiern. He took an extremely wide view of *M. rufa* including in it 3 subsequently described New Caledonian species as well as two Australian species, *M. cupulosa* F. Muell. and *M. sericocarpa* F. Muell.

The next important publication dealing with *Maba* is BAKHUIZEN's revision (1933, 1936-55) of the Malaysian and (in less detail) Pacific *Ebenaceae*. He transferred all of the Far Eastern species of *Maba* to *Diospyros*, and reduced nearly all of the true members of HIERN's

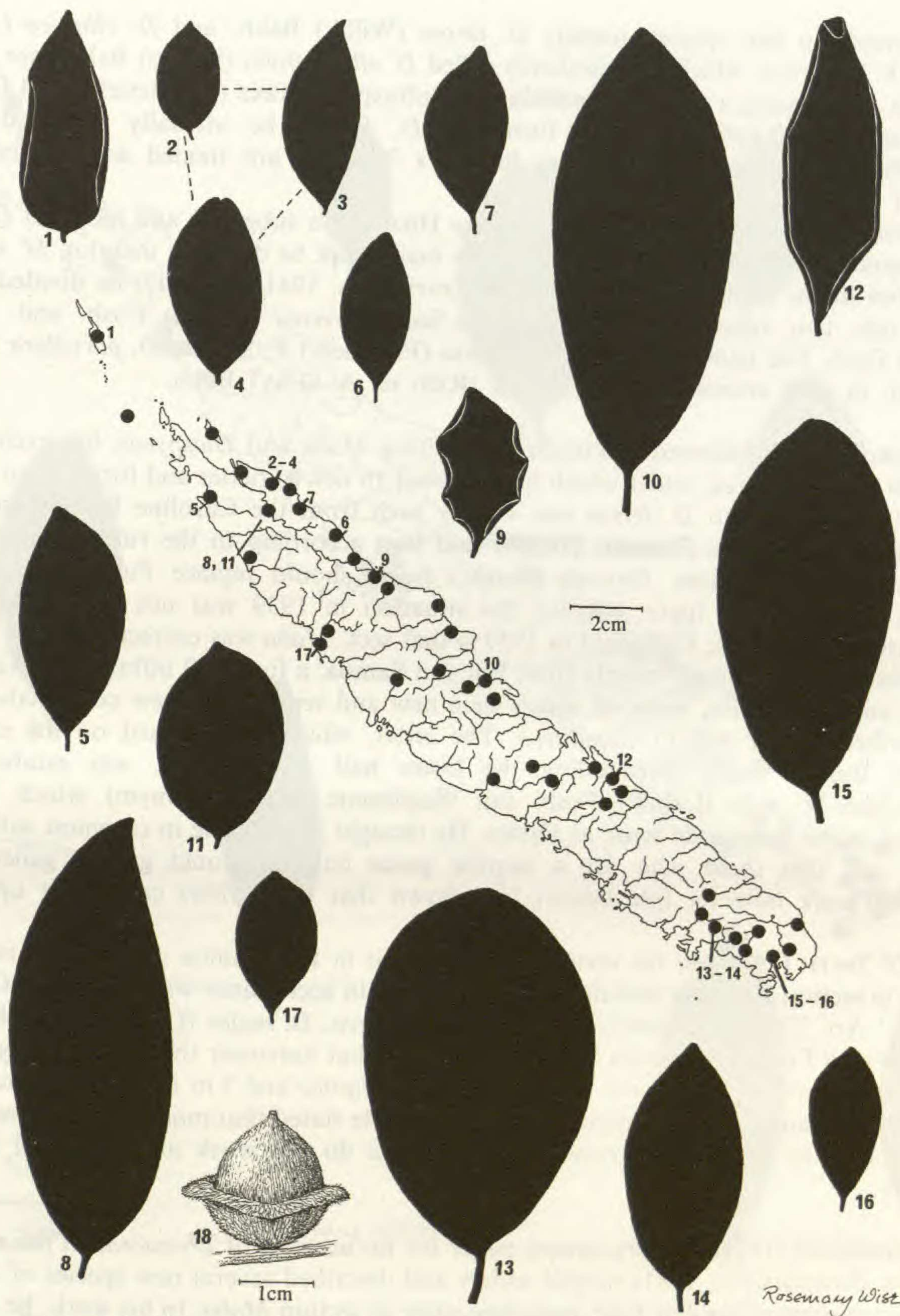


Fig. 13. — *Diospyros parviflora* (Schltr.) Bakh. 1-17, leaves selected to show the range of variation in shape and size of the species; 18, fruit and fruiting calyx (1, Veillon 2703; 2, Webster 14810; 3, Thorne 28157; 4, MacKee 24636; 5, MacKee 36424; 6, Schlechter 15533; 7, Schmid 884; 8, MacKee 33473; 9, Le Rat s.n.; 10, MacKee 36837; 11, MacKee 28998; 12, MacKee 13970; 13, McPherson 1537; 14, Brinon 865; 15, Cribbs 1388; 16, Franc 1696 A; 17, MacKee 15499; 18, MacKee 33473).

section *Ferreola* to two species, namely *D. ferrea* (Willd.) Bakh. and *D. elliptica* (J. R. & G. Forst.) P. S. Green, which he mistakenly called *D. ellipticifolia* (Stokes) Bakh. (see GREEN, 1969 : 340). By creating a chaotic assemblage of infraspecific taxa (6 varieties and 4 forms in *D. elliptica* and 20 varieties and 7 forms in *D. ferrea*, he virtually sterilized future understanding of this complex. Robert BROWN's 7 species are treated as 5 varieties and 2 forms of *D. ferrea*.

BAKHUIZEN reduced *Maba sensu lato, sensu* HIERN to a subgenus and included *D. ferrea* and *D. elliptica* in section *Forsteria* Bakh. In his main work he does not mention *M. rufa* and its allies, but in the supplement (Addenda et Corrigenda, 1941 : 428-449) he divided section *Forsteria* into two subordinate 'sections' 1a Sect. *Ferreola* (Roxb.) Fosb. and 1b Sect. *Cupulifera* Fosb. The latter included *D. cupulosa* (F. Muell.) F. Muell., *D. parviflora* (Schltr.) Bakh. and, in part erroneously, *D. foliosa* (Rich ex A. Gray) Bakh.

FOSBERG (1939a) followed BAKHUIZEN in uniting *Maba* and *Diospyros*, but excluded *M. hillebrandii* from *D. ferrea*, under which he described 16 new varieties and forms from Hawaii. He later (1940) added to *D. ferrea* one variety each from the Caroline Islands and Palau Island. In another paper, FOSBERG (1939b) said that according to the rule of priority then current, the sectional name *Ferreola* (Roxb.) Fosb. should replace *Forsteria* Bakh., but according to BRUMMITT (pers. comm.) the situation in 1939 was not clear. BRUMMITT's interpretation of what the Code said in 1939 is that sect. *Maba* was correct and sect. *Ferreola* wrong. FOSBERG also named, mainly from Fiji and Samoa, a further 7 infraspecific variants in *D. ferrea* and *D. elliptica*, some of which were new and represented new combinations, and also described a new section *Cupulifera*. The latter, which was defined on the extremely accrescent fruiting calyx surrounding the lower half of the fruit, was established to accommodate *D. rufa* (Labill.) Fosb. (an illegitimate later homonym) which FOSBERG interpreted in the same wide sense as HIERN. He thought it had little in common with section *Ferreola*, and that those who use a narrow genus concept would give it generic rank. Subsequent work however (see below) has shown that these views cannot be upheld.

A. C. SMITH (1971), in his revision of *Diospyros* in Fiji, Samoa and Tonga, recognized 4 species in section *Forsteria* (which he called '*Maba*' in accordance with 'Internat. Code Bot. Nomencl.' Art. 22, 1966), namely *D. elliptica*, *D. ferrea*, *D. major* (G. Forst.) Bakh. and *D. christophersenii* Fosb. His species concept was somewhat narrower than BAKHUIZEN's and he accepted fewer taxa of lower rank (7 varieties in *D. elliptica* and 3 in *D. ferrea*, reducing some of BAKHUIZEN's and FOSBERG's names to synonymy. He stated that most of the characters used by BAKHUIZEN to delimit *D. ferrea* and *D. elliptica* do not work and he keyed them out differently.

KOSTERMANS (1977) in a precursory paper for his account of *Ebenaceae* in the new Flora of Ceylon (KOSTERMANS, 1981) ranged widely and described several new species of *Diospyros* from various parts of the Far East, including some in section *Maba*. In his work, he found the greatest headache was BAKHUIZEN's treatment of *D. ferrea*. His partial disentanglement is certainly a step in the right direction, but several of his novelties are based on single specimens and the overall picture he presents is very incomplete. In the Flora of Ceylon (p. 9) he says that *D. ferrea* is confined to India and Sri Lanka.

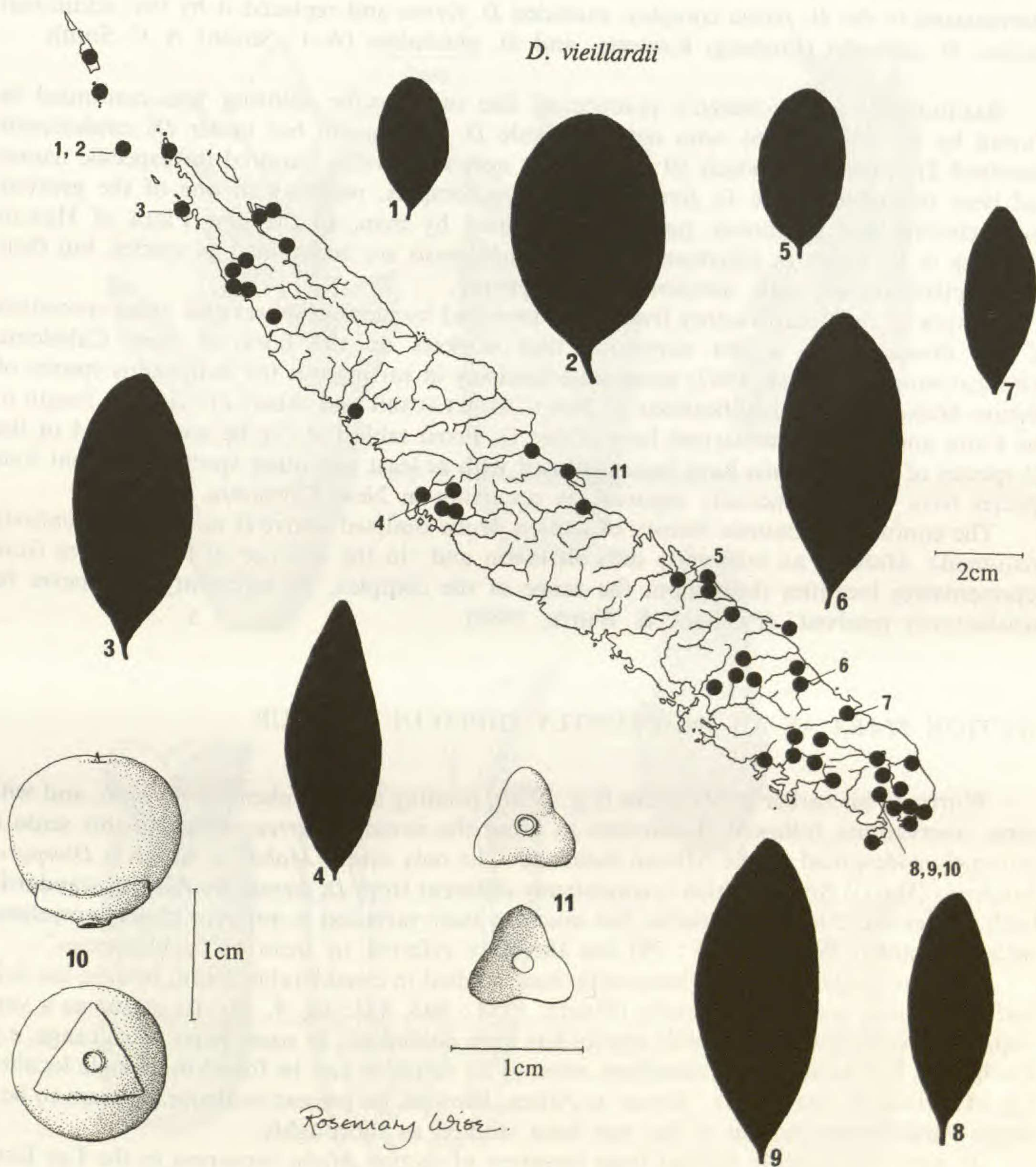


Fig. 14. — *Diospyros vieillardii* (Hiern) Kosterm. 1-9, leaves selected to show the range of variation in shape and size of the species; 10, two views of fruit; 11, two views of fruiting calyx (1, Morat 6117; 2, Veillon 3661; 3, MacKee 27453; 4, Jaffré 2874; 5, Balansa 2482; 6, Blanchon 1307; 7, MacKee 27130; 8, Franc 1722; 9, Jaffré 3026; 10, Franc 1504 A; 11, Thorne 28283).

A. C. SMITH (1981), in his Flora of Fiji, influenced by the narrower concepts of KOSTERMANS in the *D. ferrea* complex, excluded *D. ferrea* and replaced it by two additional species, *D. gillespiei* (Fosberg) Kosterm. and *D. phleboides* (A. C. Smith) A. C. Smith.

BAKHUIZEN's and FOSBERG's practice of fine infraspecific splitting was continued in Hawaii by ST. JOHN (1986), who did not divide *D. hillebrandii*, but under *D. sandwicensis* described 21 varieties, of which 10 are new. By now well over a hundred infraspecific names had been published in the *D. ferrea*, *D. elliptica* complex, resulting in one of the greatest nomenclatural and taxonomic jungles ever created by man. In the new Flora of Hawaii (WAGNER et al., 1990) *D. hillebrandii* and *D. sandwicensis* are maintained as species, but their infraspecific taxa are only mentioned in synonymy.

In view of the unsatisfactory framework provided by monographers and other specialists of the *Ebenaceae*, it is not surprising that workers on the flora of New Caledonia (GUILLAUMIN, 1922, 1948, 1967) made little headway in sorting out the indigenous species of section *Maba*. The misidentifications of HIERN, GUILLAUMIN and others are cited at length in the Flora and briefly summarized here (Table 1). From table 1 it can be seen that 14 of the 24 species of section *Maba* have been confused with at least one other species, and that four species have been erroneously reported as occurring in New Caledonia.

The confused taxonomic history of section *Maba* outlined above is not however entirely man-made. *Maba* is an inherently difficult taxon and 'in the absence of field studies from representative localities throughout the range of the complex, its taxonomy may never be satisfactorily resolved' (PANNELL & WHITE, 1988).

SECTION *MABA* AS AN INHERENTLY DIFFICULT GROUP

WHITE, in his earlier publications (e.g. 1956), pending a comprehensive revision, and with some reservations, followed BAKHUIZEN in using the name *D. ferrea*, which in this sense is extremely widespread on the African mainland. The only other '*Maba*' in Africa is *Diospyros natalensis* (Harv.) Brenan which is consistently different from *D. ferrea*. By African standards, both species are extremely variable, but much of their variation is not very closely correlated with geography. WHITE (1962 : 79) has therefore referred to them as 'ochlospecies'.

Diospyros natalensis has subsequently been studied in considerable detail, both in the field and herbarium, and experimentally (WHITE, 1988 : 343, 432; fig. 9, 10). Its status as a very variable, taxonomically indivisible species has been confirmed. In some parts of its range, e.g. Zimbabwe, it is uniform, but elsewhere, most of its variation can be found in a single locality, e.g. Mt. Mulanje, Malawi. *D. 'ferrea'* in Africa, likewise, on present evidence, appears to be a single variable species, but it has not been studied as thoroughly.

D. natalensis is quite distinct from members of section *Maba* occurring in the Far East, but several African specimens of *D. ferrea* are very similar (at least superficially) to phenotypes occurring elsewhere. The great variability within and between populations in some parts of the range of the *D. ferrea* complex, coupled with the sporadic occurrence of similar phenotypes in distant localities, has hitherto obscured the occurrence of distinct species in places such as New Caledonia where local conditions have permitted their evolution.

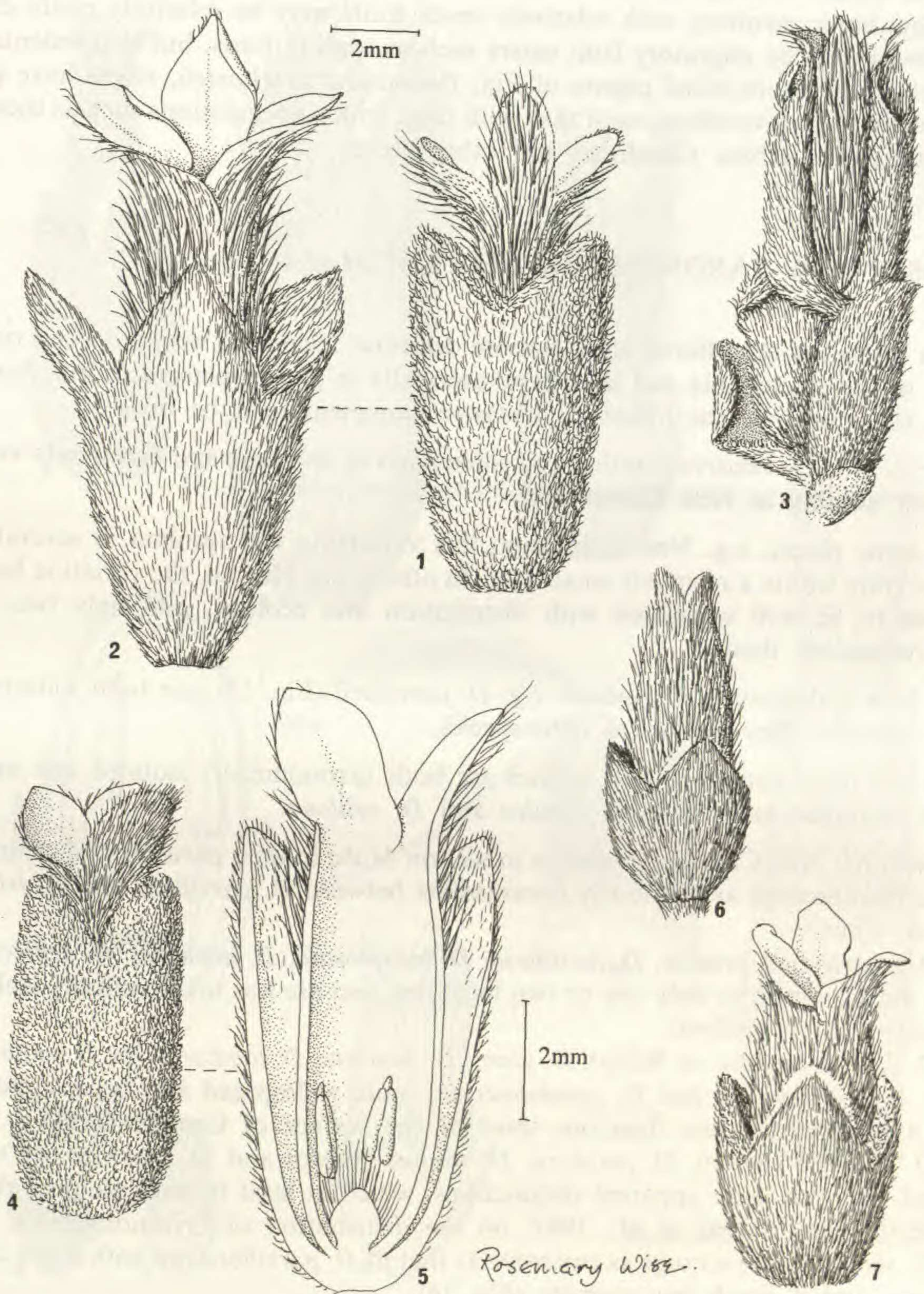


Fig. 15. — *Diospyros parviflora* (Schltr.) Bakh. : 1, male flower; 2, female flower (1, MacKee 36837; 2, Schlechter 15604). — *D. perplexa* F. White: 3, Female flower (Guillaumin & Baumann-Bodenheim 9233). — *D. yaouhensis* (Schltr.) Kosterm. : 4, male flower; 5, half of male flower in longitudinal section (4, 5, MacKee 25199). — *D. glans* F. White : 6, female flower (Jérémie & Tirel 1783). — *D. revolutissima* F. White : 7, male flower (Caldwell s.n.).

Another inherent difficulty possibly concerns dispersal. Sectio *Maba* is a tightly knit group, whose members share several distinct characters. PANNELL & WHITE (1988 : 652) have suggested that some members with relatively small fruits may be relatively easily dispersed across water barriers by migratory fruit eaters such as wading birds, but that sedentary fruit pigeons such as the tooth-billed pigeon of Fiji, *Didunculus strigirostris*, might have played a part in the more local diversification of taxa with large fruits. Speculations such as these would repay investigation in New Caledonia and other places.

TOWARDS A NEW TAXONOMY OF SECTION *MABA*

Only a few notes are offered here. A more definitive treatment would depend on further work both in New Caledonia and elsewhere, especially in New Guinea and Fiji, Samoa and Tonga. In the meantime the following tentative statements can be made.

1. Sectio *Maba* is relatively uniform in some parts of its range and excessively variable in others, most notably in New Caledonia.

2. In some places, e.g. New Caledonia, this variability has resulted in several discrete species occurring within a relatively small area. In others, e.g. Hawaii, the variation has not yet been shown to be well correlated with distribution and ecology, and only two taxa are currently recognized there.

3. In New Caledonia some species, e.g. *D. parviflora* (Fig. 13), are both widespread and extremely variable, they behave as ochlopecies.

4. At the other extreme, some species are both taxonomically isolated and are known only from restricted areas, e.g. *D. trisulca* and *D. veillonii*.

5. The other New Caledonian species in section *Maba* in their patterns of distribution and taxonomic relationships are variously intermediate between *D. parviflora* and *D. trisulca* and *D. veillonii*. Thus :

— *D. cherrieri*, *D. erudita*, *D. fastidiosa*, *D. inexplorata*, *D. nebulosa*, *D. neglecta* and *D. tridentata* are known from only one or two localities, and are less taxonomically isolated than *D. trisulcata* and *D. veillonii*.

— *D. flavocarpa* (also on Bélep), *D. glans*, *D. impolita*, *D. labillardierei*, *D. minimifolia*, *D. pustulata*, *D. revolutissima* and *D. yaouhensis* are more widespread and occupy more or less compact areas covering less than one third of the surface of Grande-Terre.

— *D. pancheri* (Bélep), *D. perplexa*, *D. tireliae* (Bélep) and *D. umbrosa* are even more widespread but with large apparent disjunctions, which at least in part are probably due to undercollecting (see JAFFRÉ et al., 1987, on the distribution of Gymnosperms).

— *D. vieillardii* has a range as extensive as that of *D. parviflora* but with a less continuous distribution, and is much less variable (Fig. 14).

— *D. calciphila* is widespread in the Loyalty Island and on the Ile des Pins but is not recorded from Grande-Terre. It is the only representative of section *Maba* in the Loyalty Islands.

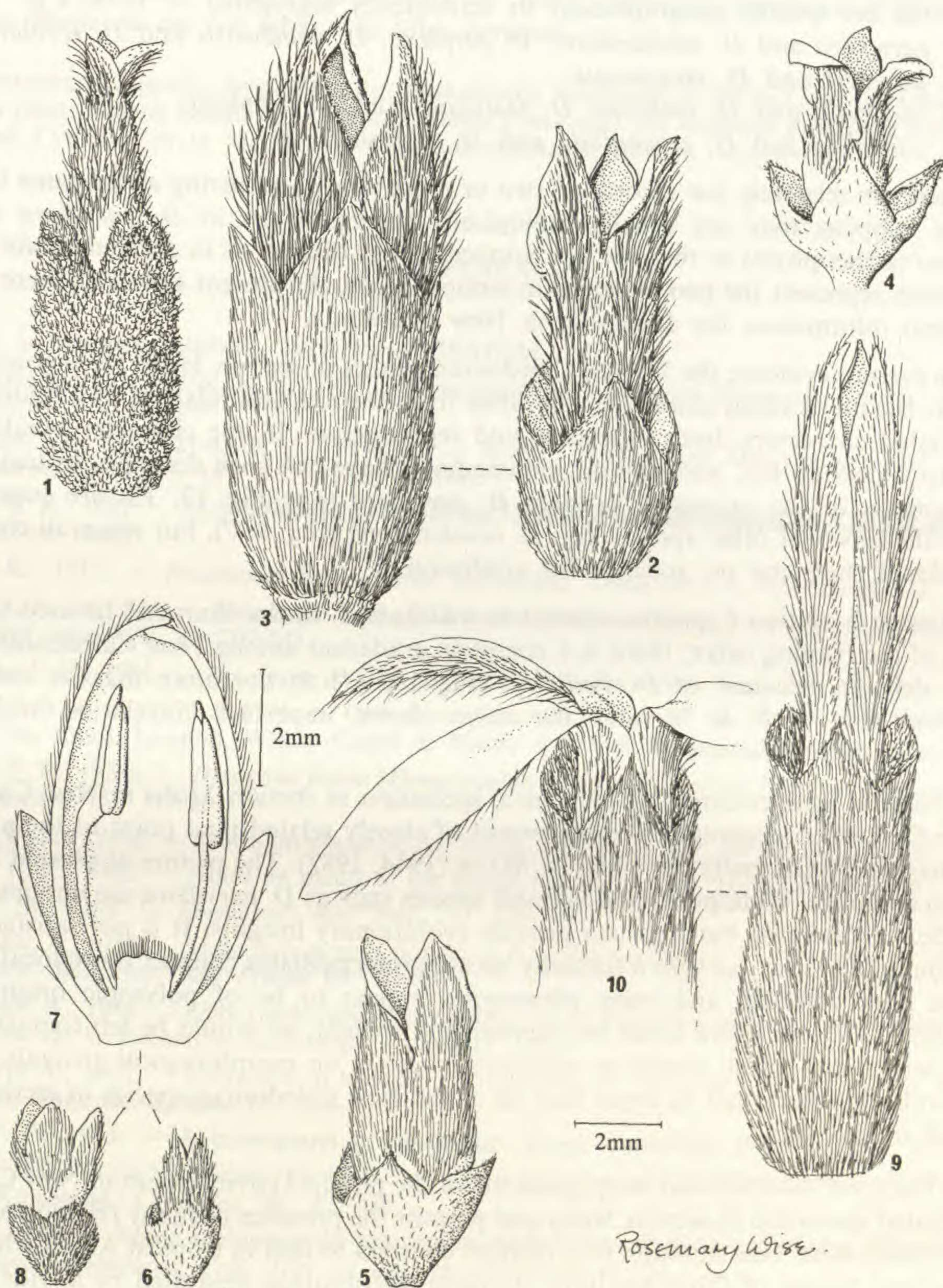


Fig. 16. — *Diospyros impolita* F. White : 1, female flower (MacKee 8048). — *D. veillonii* F. White : 2, male flower ; 3, female flower (2, Veillon 7203 ; 3, Veillon 7202). — *D. vieillardii* (Hiern) Kosterm. : 4, male flower (MacKee 14455). — *D. fastidiosa* F. White : 5, male flower (MacKee 25369). — *D. minimifolia* F. White : 6, male flower-bud ; 7, half of male flower-bud in longitudinal section ; 8, female flower (6, 7, MacKee 24998 ; 8, MacKee 25013). — *D. trisulca* F. White : 9, male flower-bud ; 10, part of male corolla (9, 10, Veillon et al. 7446).

6. Each species has a distinct ecogeographical profile. Those species that appear to be closely related are usually geographically or ecologically segregated or both, e.g. :

- *D. parviflora* and *D. labillardierei*, *D. perplexa*, *D. yaouhensis* and *D. revolutissima*;
- *D. pancheri* and *D. inexplorata*;
- *D. vieillardii* and *D. umbrosa*, *D. fastidiosa* and *D. nebulosa*;
- *D. calciphila* and *D. minimifolia* and *D. tridentata*.

7. There are relatively few records of two or more species occurring at the same locality. When this happens they are usually ecologically segregated as in *D. parviflora* and *D. labillardierei* (a rheophyte) or they are taxonomically very distinct as in *D. minimifolia* and *D. veillonii* which represent the two extremes in section *Maba*. At present however, there is little synecological information for *Diospyros* in New Caledonia.

8. On present evidence the 24 New Caledonian species of section *Maba* are taxonomically distinct. As the illustrations show, they all differ from their closest relatives in a multitude of well correlated characters, both vegetative and reproductive. If one character breaks down most of the others do not, and genuine intermediates have not been detected. In leaf outline some specimens of the extremely variable *D. parviflora* (e.g. Fig. 13, 12) are superficially similar to the leaves of other species, e.g. *D. revolutissima* (Fig. 6, 7), but when all characters are considered there are no grounds for confusion.

9. FOSBERG's section *Cupulifera* cannot be maintained. In the character he used (size and thickness of the fruiting calyx) there is a complete gradation among New Caledonian species from the delicate structure of *D. vieillardii* (Fig. 14, 11) to the more massive one of *D. revolutissima* (Fig. 6, 8 & 9), and the calyx shows imperfect correlation with other taxonomically useful features.

10. There is little evidence for sympatric speciation in section *Maba* in New Caledonia, where the facts of ecogeographical replacement of closely related taxa point to the allopatric model advocated (principally for birds) by MAYR (1944, 1982). The picture at present however is far from complete. Widespread and variable species such as *D. parviflora* are unpopular with tidy-minded taxonomists but they can provide evolutionary insights. It is not satisfactory, in my opinion, to divide *D. parviflora* formally because intermediates connect those local variants that have been detected, and some phenotypes appear to be of polytopic origin. If the intermediates in *D. parviflora* could be exterminated tonight, we would be left tomorrow with half-a-dozen entities which would be sufficiently distinct on morphological grounds to merit specific rank. But this is not to argue that all of the New Caledonian species in section *Maba* originated in this way.

11. The great diversity and steep gradients in the physical environment in New Caledonia has facilitated speciation in section *Maba* and permits the presence of many related species in a relatively small area. This situation is in marked contrast to that in tropical Africa where some closely related species of *Diospyros* have extensive distributions separated by a wide interval, e.g. *D. monbuttensis* and *D. senensis* (WHITE 1962 : Fig. 3). In Africa, species occupying more restricted areas are frequently taxonomically isolated, e.g. many Guineo-Congolian species (WHITE, 1978a, 1978b).

12. Considerations such as those outlined above underline the danger of making

biological generalizations from a knowledge of limited geographical areas or from limited taxonomic experience. When I started work on New Caledonian *Ebenaceae* my previous work had not prepared me for what was later revealed.

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Pollen morphology of Madagascan *Aristea* and *Geosiris* (*Iridaceae-Nivenioideae*) in relation to systematics and phylogeny

P. GOLDBLATT & A. LE THOMAS

Summary : Specialization from the presumed basic monosulcate and semitectate-reticulate pollen grains of *Iridaceae* is evident in all six species of *Aristea* in Madagascar. Disulcate grains are characteristic of *A. cladocarpa* and *A. nitida*, and although the two species are currently assigned to different sections, morphology suggests that they are closely related, and perhaps most closely allied to the tropical African *A. ecklonii*, which has monosulcate grains. *Aristea humbertii* and *A. madagascariensis* have operculate (-pontoperculate) grains, while four samples of *A. kitchingii* exhibit variation ranging from predominantly disulcate in two samples to predominantly zonasulcate in the other two. Porate anther dehiscence is restricted in *Aristea* to these three species, which appear to comprise a monophyletic lineage. The disulcate grains of *A. angustifolia* may link these three species to tropical African members of section *Euaristea*, here renamed section *Eucapsulares* (*Euaristea* does not include the type of the genus). Pollen grains of *Geosiris* accord with the basic type in *Iridaceae*, but appear less specialized than those of the Madagascan species of *Aristea*. Pollen grains of *Aristea* are in general more variable than in most other genera of *Iridaceae* and need further investigation. *Patersonia*, included in the study because it is the only Australasian genus of *Nivenioideae* and may be closely related to *Aristea*, has inaperturate, intectate pollen grains with an unusual sculpturing.

Résumé : Les types polliniques dérivés des grains monosulqués et semi-tectés réticulés, primitifs chez les *Iridaceae*, sont particulièrement diversifiés dans les six espèces malgaches d'*Aristea*. *Aristea cladocarpa* et *A. nitida* sont caractérisés par un pollen disulqué; bien que ces deux espèces appartiennent actuellement à deux sections différentes, la macromorphologie suggère qu'elles sont très affines et probablement les plus proches de l'espèce africaine *A. ecklonii* dont le pollen est monosulqué. Le pollen d'*A. humbertii* et *A. madagascariensis* est monosulqué operculé (ou pontoperculé), tandis que celui d'*A. kitchingii* est particulièrement diversifié. En effet, parmi les quatre spécimens étudiés pour cette espèce, deux d'entre eux ont une majorité de grains disulqués, alors que dans les deux autres les grains sont en grande partie zonasulculés. Seules ces trois dernières espèces d'*Aristea*, qui apparaissent constituer une lignée monophylétique, possèdent des anthères à déhiscence poricide. Le pollen disulqué d'*A. angustifolia* pourrait constituer un lien entre cette lignée et les espèces tropicales africaines appartenant à la section *Euaristea*, nommée ici *Eucapsulares* (*Euaristea* ne renferme pas le type du genre). Le pollen de *Geosiris* ressemble au type de base des *Iridaceae*; il est moins spécialisé que celui d'*Aristea* dont la variation est en général plus importante que dans la plupart des autres genres d'*Iridaceae* et qui nécessite de futures investigations. Le pollen de *Patersonia* est inclus dans cette étude comme seul genre australien appartenant aux *Nivenioideae* et proche des *Aristea*. Il est inaperturé, presque intecté, à ornementation inhabituelle dans la famille.

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